Tektronix

MP MASTER

MA33267

Service Manual

Tektronix

TDS 340A, TDS 360 & TDS 380 Digital Real-Time Oscilloscopes

070-9435-03

This document applies to firmware version 1.05 and above.

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

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WARRANTY

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of three (3) years from the date of purchase from an authorized Tektronix distributor. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Batteries are excluded from this warranty.

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Table of Contents

General Safety Summary ..... **vii**
Service Safety Summary ..... **xi**
Preface ..... **xiii**

Specifications

Warranted Characteristics 1–1
Typical Characteristics 1–5
Nominal Traits 1–7

Operating Information

Display and Power Controls 2–1
Vertical Controls 2–2
Horizontal Controls 2–2
Trigger Controls 2–3
Inputs 2–3
Miscellaneous Controls 2–4
Display Map 2–5
Rear-Panel Connectors 2–6
Using the Menu System 2–7

Theory of Operation

Logic Conventions 3–1
Module Overview 3–1

Performance Verification

Conventions **4–1**
Test Equipment 4–3
Test Record 4–4
Self Test **4–5**
Functional Test **4–7**
Performance Tests **4–11**
Prerequisites 4–11
Signal Acquisition System Checks 4–11
Time Base System Checks 4–16
Trigger System Checks 4–18
Sine Wave Generator Leveling Procedure 4–20

Adjustment Procedures

Equipment Required 5–1
The System Calibration Menu 5–2
Attenuator Adjustment 5–4
Monitor Adjustments 5–6

Maintenance

Preventing ESD 6–1
General Care 6–2
Inspection and Cleaning Procedures 6–2
Removal and Replacement 6–5
Preparation — Please Read 6–5
Line Fuse and Line Cord 6–8
Front Panel Knobs and Shafts 6–10
Rear Cover, Cabinet, and Cabinet Handle 6–11
Disk Drive 6–13
Trim Ring, Menu Elastomer, Menu Buttons, and Front EMI Gaskets 6–14
Front Panel Assembly and Menu Flex Circuit 6–16
Main Board Assembly 6–18
Monitor Assembly 6–21
Power Supply Assembly 6–23
Option 14 Assembly 6–25
Fan and Fan Mount 6–27
Troubleshooting 6–29
Onboard Diagnostics 6–29
Enabling Calibration Menus 6–31
Troubleshooting Procedure 6–32
Repackaging Instructions 6–43

Options

Options 7–1
Standard Accessories 7–3
Optional Accessories 7–3
Accessory Probes 7–4
Accessory Cables 7–4

Electrical Parts List

Electrical Parts List 8–1

Diagrams

Diagrams 9–1

Mechanical Parts List

Parts Ordering Information 10–1
Using the Replaceable Parts List 10–2

List of Figures

Figure 1–1: TDS 340A, TDS 360, & TDS 380 dimensions 1–11

Figure 2–1: A pop-up menu 2–8
Figure 2–2: Using menus 2–9

Figure 3–1: TDS 340A, TDS360, & TDS380 block diagram 3–2
Figure 3–2: TDS 340A, TDS360, & TDS380 block diagram with Option 14 3–3

Figure 4–1: Menu locations 4–2
Figure 4–2: Verifying adjustments and signal path compensation 4–6
Figure 4–3: Hookup for functional test 4–7
Figure 4–4: Hookup for file system functional test 4–9
Figure 4–5: Hookup for DC voltage measurement accuracy check 4–12
Figure 4–6: Hookup for analog bandwidth check 4–14
Figure 4–7: Measuring analog bandwidth 4–15
Figure 4–8: Hookup for sample rate check 4–16
Figure 4–9: Hookup for trigger sensitivity check 4–18
Figure 4–10: Measuring trigger sensitivity 4–19
Figure 4–11: Hookup for sine wave generator leveling 4–21

Figure 5–1: The system calibration menu 5–2
Figure 5–2: Timing compensation waveform 5–4
Figure 5–3: Attenuator adjustment setup and locations 5–5
Figure 5–4: Monitor adjustments 5–7

Figure 6–1: Oscilloscope orientation 6–6
Figure 6–2: Line cord removal 6–8
Figure 6–3: Line fuse removal 6–9
Figure 6–4: Knob and shaft removal 6–10
Figure 6–5: Rear cover, cabinet, and cabinet handle and feet removal 6–12
Figure 6–6: Removing the disk drive 6–13
Figure 6–7: Trim ring, menu elastomer, and menu buttons removal 6–14

Figure 6–8: EMI gasket removal and installation 6–16
Figure 6–9: Front panel assembly and menu flex circuit removal 6–17
Figure 6–10: Removing the floppy interface board 6–19
Figure 6–11: Removing the main board 6–20
Figure 6–12: Monitor assembly removal 6–22
Figure 6–13: Low voltage power supply removal 6–24
Figure 6–14: Option 14 assembly removal 6–26
Figure 6–15: Fan and fan mount removal 6–27
Figure 6–16: The diagnostics menu 6–29
Figure 6–17: The error log 6–31
Figure 6–18: Main board cal jumper 6–32
Figure 6–19: Primary troubleshooting procedure 6–33
Figure 6–20: Module isolation troubleshooting procedure 6–34
Figure 6–21: Front panel/processor troubleshooting procedure 6–35
Figure 6–22: Monitor troubleshooting procedure 6–36
Figure 6–23: J901 pin 7 signal 6–37
Figure 6–24: J901 pin 2 signal 6–37
Figure 6–25: J901 pin 5 signal 6–38
Figure 6–26: Power supply troubleshooting procedure 6–39
Figure 6–27: Power supply connector locations 6–40
Figure 6–28: Power supply overload troubleshooting procedure 6–41
Figure 6–29: Option 14 I/O interfaces troubleshooting procedure 6–42

Figure 10–1: Cabinet and front panel assembly 10–6
Figure 10–2: CRT, power supply, and circuit boards 10–8
Figure 10–3: Accessories 10–10

List of Tables

Table 1–1: Warranted characteristics — signal acquisition system 1–1
Table 1–2: Warranted characteristics — time base system 1–2
Table 1–3: Warranted characteristics — triggering system 1–3
Table 1–4: Power Requirements 1–3
Table 1–5: Warranted characteristics — environmental 1–4
Table 1–6: Typical characteristics — signal acquisition system 1–5
Table 1–7: Typical characteristics — triggering system 1–6
Table 1–8: Typical characteristics — probe compensator output ... 1–6
Table 1–9: Typical characteristics — data handling 1–7
Table 1–10: Nominal traits — signal acquisition system 1–7
Table 1–11: Nominal traits — time base system 1–8
Table 1–12: Nominal traits — triggering system 1–8
Table 1–13: Nominal traits — display system 1–9
Table 1–14: Nominal traits — Option 14 I/O interface option (TD3F14A) 1–9
Table 1–15: Nominal traits — power distribution system 1–9
Table 1–16: Nominal traits — mechanical characteristics 1–10
Table 1–17: Certifications and compliances 1–12

Table 4–1: Test equipment 4–3
Table 4–2: DC accuracy 4–11

Table 5–1: Adjustment equipment 5–1

Table 6–1: External inspection check list 6–3
Table 6–2: Internal inspection check list 6–4
Table 6–3: Tools required for module removal 6–6
Table 6–4: Power supply secondary voltages 6–40

Table 7–1: VGA output connector pins **7–1**
Table 7–2: International power cords **7–2**
Table 7–3: Language options **7–2**
Table 7–4: Standard accessories **7–3**
Table 7–5: Optional accessories **7–3**
Table 7–6: Accessory cables **7–4**

Table 10–1: Certifications and compliances **10–1**

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use the product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

Injury Precautions

Use Proper Power Cord. To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload. To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Avoid Overvoltage. To avoid electric shock or fire hazard, do not apply potential to any terminal, including the common terminal, that varies from ground by more than the maximum rating for that terminal.

Avoid Electric Shock. To avoid injury or loss of life, do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Do Not Operate Without Covers. To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse. To avoid fire hazard, use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions. To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere. To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Avoid Exposed Circuitry. To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

Keep Probe Surface Clean and Dry. To avoid electric shock and erroneous readings, keep probe surface clean and dry.

Wear Eye Protection. To avoid eye injury, wear eye protection if there is a possibility of exposure to high-intensity rays.

Product Damage Precautions

Use Proper Power Source. Do not operate this product from a power source that applies more than the voltage specified.

Provide Proper Ventilation. To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Immerse in Liquids. Clean the probe using only a damp cloth. Refer to cleaning instructions.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:

DANGER
High Voltage

Protective Ground
(Earth) Terminal

ATTENTION
Refer to Manual

Double
Insulated

Certifications and Compliances

Refer to the specifications section for a listing of certifications and compliances that apply to this product.

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power. To avoid electric shock, disconnect the main power by means of the power cord or, if provided, the power switch.

Use Caution When Servicing the CRT. To avoid electric shock or injury, use extreme caution when handling the CRT. Only qualified personnel familiar with CRT servicing procedures and precautions should remove or install the CRT.

CRTs retain hazardous voltages for long periods of time after power is turned off. Before attempting any servicing, discharge the CRT by shorting the anode to chassis ground. When discharging the CRT, connect the discharge path to ground and then the anode. Rough handling may cause the CRT to implode. Do not nick or scratch the glass or subject it to undue pressure when removing or installing it. When handling the CRT, wear safety goggles and heavy gloves for protection.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

X-Radiation. To avoid x-radiation exposure, do not modify or otherwise alter the high-voltage circuitry or the CRT enclosure. X-ray emissions generated within this product have been sufficiently shielded.

Preface

This service manual provides service information for the TDS 340A, TDS 360, and TDS 380 Digitizing Oscilloscopes.

Manual Structure

This manual is divided into Chapters such as *Specifications* and *Theory of Operation*. Further, it is divided into subsections such as *Product Description* and *Removal and Installation Procedures*.

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following is a brief description of each manual chapter.

- *Specifications* contains a product description of the digitizing oscilloscope and tables of the characteristics and descriptions that apply to it.
- *Operating Information* includes general information and operating instructions at the level needed to safely power on and service this oscilloscope.
- *Theory of Operation* contains circuit descriptions that support general service and fault isolation down to the module level.
- *Performance Verification* contains a collection of procedures for confirming that this digitizing oscilloscope functions properly and meets warranted limits.
- *Adjustment Procedures* contains a collection of procedures for adjusting this digitizing oscilloscope to meet warranted limits.
- *Maintenance* contains information and procedures for doing preventive and corrective maintenance of the digitizing oscilloscope. Instructions for cleaning, for module removal and installation, and for fault isolation to a module are found here.
- *Options* contains information on the factory-installed options that may be present in your oscilloscope.
- *Electrical Parts List* contains a statement referring you to the *Mechanical Parts List,* where both electrical and mechanical modules are listed.

- *Diagrams* contains a statement referring you to the *Theory of Operation* Chapter, where module-level block diagrams are listed.
- *Mechanical Parts List* includes a table of all replaceable modules, their descriptions, and their Tektronix part numbers.

Manual Conventions

This manual uses certain conventions which you should become familiar with before doing service.

Modules

Throughout this manual, any replaceable component, assembly, or part of this digitizing oscilloscope is referred to generically as a module. In general, a module is an assembly, like a circuit board, rather than a component, like a resistor or an integrated circuit. Sometimes a single component is a module; for example, the chassis of the oscilloscope is a module.

Safety

Symbols and terms related to safety appear in the *General Safety Summary* and *Service Safety Summary* found at the beginning of this manual.

Symbols

Besides the symbols related to safety, this manual uses the following symbols:

STOP. *This "stop sign" labels information which you must read in order to correctly do service and to avoid incorrectly using or applying service procedures.*

Related Manuals

These other manuals are available for the TDS 340A, TDS 360, and TDS 380 Digitizing Oscilloscopes.

- The *Reference Manual* gives you a quick overview of how to operate your oscilloscope.
- The *User Manual* provides instructions on how to operate your oscilloscope.
- The *Programmer Manual* provides complete information on programming and remote control of the oscilloscope through the GPIB or RS-232 interface (optional accessory).

Specifications

This appendix contains complete specifications for the TDS 340A, TDS 360, and TDS 380. The specifications are divided into three subsections, one for each of three classes of traits: *Warranted Characteristics, Typical Characteristics,* and *Nominal Traits.*

Warranted Characteristics

Warranted characteristics are described in terms of quantifiable performance limits that are warranted. This subsection lists only warranted characteristics.

NOTE. *In these tables, those warranted characteristics that are checked in the* Performance Tests, *starting on page 4–11, appear in* ***boldface type*** *under the column* **Name**.

Performance Conditions

The electrical characteristics found in these tables of warranted characteristics apply when the oscilloscope has been adjusted at an ambient temperature between +20° C and +30° C, has had a warm-up period of at least 20 minutes, and is operating at an ambient temperature between –10° C and +55° C (unless otherwise noted).

Table 1–1: Warranted characteristics — signal acquisition system

Name	Description	
Accuracy, DC Voltage Measurement, Average Acquisition Mode	**Measurement type**	**DC accuracy**
	Average of ≥16 waveforms	±(2.0% × |(reading – Net Offset[1])| + Offset Accuracy + 0.1 div)
	Delta volts between any two averages of ≥16 waveforms acquired under the same setup and ambient conditions	±(2.0% × |reading| + 0.15 div + 0.3 mV)
Accuracy, DC Gain, Sample or Average Acquisition Modes	±2%	
Pulse Response, Peak Detect and Envelope Mode	**Sec/Div setting**	**Minimum pulse width**
	5 s/div – 25 µs/div	10 ns
	TDS 340A: 10 µs/div – 5 ns/div TDS 360: 10 µs/div – 2.5 ns/div TDS 380: 10 µs/div – 1 ns/div	The greater of 10 ns or .02 × sec/div setting

Table 1–1: Warranted characteristics — signal acquisition system (Cont.)

Name	Description	
Accuracy, Offset	**Volts/Div setting**	**Offset accuracy**
	2 mV/div – 99.5 mV/div	±(0.4% × |Net Offset[1]| + 3 mV + 0.1 div × V/div setting)
	100 mV/div – 995 mV/div	±(0.4% × |Net Offset[1]| + 30 mV + 0.1 div × V/div setting)
	1 V/div – 10 V/div	±(0.4% × |Net Offset[1]| + 300 mV + 0.1 div × V/div setting)
Analog Bandwidth, DC Coupled	TDS 340A: DC – ≥100 MHz TDS 360: DC – ≥200 MHz; DC – ≥180 MHz for 2 mV/div TDS 380: DC – ≥400 MHz; DC – ≥250 MHz for 2 mV/div	
Cross Talk (Channel Isolation)	≥100:1 at 50 MHz with equal Volts/Div settings on each channel	
Input Impedance, DC-Coupled	TDS 340A: 1 MΩ ±1% in parallel with 20 pF ±2.0 pF TDS 360: 1 MΩ ±1% in parallel with 20 pF ±2.0 pF TDS 380: 1 MΩ ±1% in parallel with 12 pF ±2.0 pF	
Input Voltage, Maximum	±300 V (DC or AC) CAT II; derate at 20 dB/decade above 100 kHz to 13 V peak AC at 3 MHz and above	
Lower Frequency Limit, AC Coupled[2]	≤10 Hz	

1 **Net Offset = Offset – (Position × Volts/Div). Net offset is the voltage level at the center of the A-D converter dynamic range. Offset Accuracy is the accuracy of this voltage level.**

2 **The AC Coupled Lower Frequency Limits are reduced by a factor of 10 when 10X, passive probes are used.**

Table 1–2: Warranted characteristics — time base system

Name	Description
Accuracy, Long Term Sample Rate and Delay Time	±100 ppm over any ≥1 ms interval
Accuracy, Delta Time Measurements[1, 2]	For single-shot acquisitions using sample acquisition mode and a bandwidth limit setting of FULL: ±(1 WI + 100 ppm × |Reading| + 0.6 ns) For repetitive acquisitions using average acquisition mode with ≥16 averages and a bandwidth limit setting of FULL: ±(1 WI + 100 ppm × |Reading| + 0.4 ns)

1 **For input signals ≥5 divisions in amplitude and a slew rate of ≥2.0 divisions/ns at the delta time measurement points. Signal must be acquired at a volts/division setting ≥5 mV/division.**

2 **The WI (waveform interval) is the time between the samples in the waveform record. Also, see the footnotes for *Sample Rate Range* and *Equivalent Time or Interpolated Waveform Rates* in Table 1–11 on page 1–8.**

Table 1–3: Warranted characteristics — triggering system

Name	Description	
Accuracy, Trigger Level, DC Coupled	**Trigger source**	**Sensitivity**
	CH1 or CH2	±(3% of |Setting – Net Offset[1]| + 0.2 div × volts/div setting + Offset Accuracy)
	External	±(6% of |Setting| + 20 mV)
	External/10	±(6% of |Setting| + 200 mV)
Sensitivity, Edge-Type Trigger, DC Coupled	**Trigger source**	**Sensitivity**
	CH1 or CH2	TDS 340A: 0.35 division from DC to 20 MHz, increasing to 1 div at 100 MHz TDS 360: 0.35 division from DC to 50 MHz, increasing to 1 div at 200 MHz TDS 380: 0.35 division from DC to 50 MHz, increasing to 1 div at 400 MHz
	External	TDS 340A: 50 mV from DC to 20 MHz, increasing to 150 mV at 100 MHz TDS 360: 50 mV from DC to 50 MHz, increasing to 150 mV at 200 MHz TDS 380: 50 mV from DC to 50 MHz, increasing to 500 mV at 400 MHz
	External/10	TDS 340A: 500 mV from DC to 20 MHz, increasing to 1.5 V at 100 MHz TDS 360: 500 mV from DC to 50 MHz, increasing to 1.5 V at 200 MHz TDS 380: 500 mV from DC to 50 MHz, increasing to 5.0 V at 400 MHz
Input Impedance, External Trigger	1 MΩ ±2% in parallel with 20 pF ±2 pF	
Maximum Input Voltage, External Trigger	±300 V (DC or AC) CAT II; derate at 20 dB/decade above 100 kHz to 13 V peak AC at 3 MHz and above	

1 **Net Offset = Offset – (Position × Volts/Div). Net Offset is the voltage level at the center of the A-D converter dynamic range. Offset Accuracy is the accuracy of this voltage level.**

Table 1–4: Power Requirements

Name	Description
Source Voltage and Frequency	90 to 132 VAC_{RMS}, continuous range, for 47 Hz through 440 Hz 132 to 250 VAC_{RMS}, continuous range, for 47 Hz through 63 Hz
Power Consumption	≤65 Watts (120 VA)

Table 1–5: Warranted characteristics — environmental

Name	Description
Atmospherics (TDS 340A, TDS 360 or TDS 380)	Temperature without diskette in floppy disk drive: +4° C to +50° C, operating; –22° C to +60° C, non-operating Temperature with diskette in floppy disk drive: +10° C to +50° C, operating or non-operating Relative humidity without diskette in floppy disk drive: to 80% at or below +29° C, or to 20% from +30° C to +50° C, operating; to 90% at or below +40° C, or to 5% from +41° C to +50° C, non-operating; Relative humidity with diskette in floppy disk drive: to 80% at or below +29° C, or to 20% from +30° C to +50° C, operating or non-operating Altitude: To 15,000 ft (4570 m), operating; to 40,000 ft (12190 m), non-operating
Dynamics	Random vibration without diskette in floppy disk drive: 0.31 g_{RMS}, from 5 to 500 Hz, 10 minutes each axis, operating; 2.46 g_{RMS}, from 5 to 500 Hz, 10 minutes each axis, non-operating

Typical Characteristics

Typical characteristics are described in terms of typical or average performance. Typical characteristics are not warranted.

Table 1–6: Typical characteristics — signal acquisition system

Name	Description			
Accuracy, DC Gain, Envelope Acquisition Mode	±3% for sec/div settings from 5 Sec/Div to 25 µsec/div; ±2% for sec/div settings from 10 µs/div to 5 ns/div (TDS 340A); ±2% for sec/div settings from 10 µs/div to 2.5 ns/div (TDS 360); ±2% for sec/div settings from 10 µs/div to 1 ns/div (TDS 380)			
Accuracy, DC Voltage Measurement, Sample Acquisition Mode	**Measurement type**		**DC accuracy**	
	Any Sample		±(2.0% × (Ireading – Net Offset[1]I) + Offset Accuracy + 0.13 div + 0.6 mV)	
	Delta Volts between any two samples[2] acquired under the same setup and ambient conditions		±(2.0% × Ireadingl + 0.26 div + 1.2 mV)	
Frequency Limit, Upper, 20 MHz Bandwidth Limited	20 MHz			
Step Response Settling Error	**Volts/Div setting**	**Step amplitude**	**Settling error (%)[3]**	
			100 ns	**20 ms**
	2 mV/div – 99.5 mV/div	≤2 V	≤1.0	≤0.1
	100 mV/div – 995 mV/div	≤20 V	≤1.5	≤0.2
	1 V/div – 10 V/div	≤200 V	≤2.5	≤0.2
Common Mode Rejection Ratio (CMRR)	100:1 at 60 Hz, reducing to 20:1 at 50 MHz, with equal Volts/Div and Coupling settings on each channel.			

1 **Net Offset = Offset – (Position × Volts/Div). Net Offset is the voltage level at the center of the A-D converter dynamic range. Offset Accuracy is the accuracy of this voltage level.**

2 **The samples must be acquired under the same setup and ambient conditions.**

3 **The values given are the maximum absolute difference between the value at the end of a specified time interval after the mid-level crossing of the step, and the value one second after the mid-level crossing of the step, expressed as a percentage of the step amplitude.**

Table 1–7: Typical characteristics — triggering system

Name	Description	
Error, Trigger Position, Edge Triggering	**Acquire mode**	**Trigger-position error[1,2]**
	Sample, Average	±(1 WI + 2 ns)
	Peak Detect, Envelope	±(2 WI + 2 ns)
Sensitivity, Video-Type Trigger	**Source**	**Typical sensitivity**
	CH1 or CH2 External External/10	0.6 division of video sync signal 75 mV of video sync signal 750 mV of video sync signal
Lowest Frequency for Successful Operation of "Set Level to 50%" Function	50 Hz	
Sensitivity, Edge Type Trigger, Not DC Coupled[3]	**Trigger coupling**	**Typical signal level for stable triggering**
	AC	Same as DC-coupled limits[4] for frequencies above 60 Hz. Attenuates signals below 60 Hz.
	Noise Reject	Three and one half times the DC-coupled limits.[4]
	High Frequency Reject	One and one half times times the DC-coupled limits[4] from DC to 30 kHz. Attenuates signals above 30 kHz.
	Low Frequency Reject	One and one half times the DC-coupled limits[4] for frequencies above 80 kHz. Attenuates signals below 80 kHz.

1 The trigger position errors are typically less than the values given here. These values are for triggering signals having a slew rate at the trigger point of ±0.5 division/ns.

2 The waveform interval (WI) is the time between the samples in the waveform record. Also, see the footnote for the characteristics *Sample Rate Range* and *Equivalent Time or Interpolated Waveform Rates* in Table 1–11 on page 1–8.

3 The minimum sensitivity for obtaining a stable trigger. A stable trigger results in a uniform, regular display triggered on the selected slope. The trigger point must not switch between opposite slopes on the waveform, and the display must not "roll" across the screen on successive acquisitions. The TRIG'D LED stays constantly lighted when the SEC/DIV setting is 2 ms or faster but may flash when the SEC/DIV setting is 10 ms or slower.

4 See the characteristic *Sensitivity, Edge-Type Trigger, DC Coupled* in Table 1–3, which begins on page 1–3.

Table 1–8: Typical characteristics — probe compensator output

Name	Description	
Output Voltage and Frequency, Probe Compensator	**Characteristic**	
	Voltage	5.0 V (low-high) into a 1 MΩ load
	Frequency	1 kHz

Table 1–9: Typical characteristics — data handling

Name	Description
Time, Data-Retention, Nonvolatile Memory[1,2]	≥5 Years

1 **The time that reference waveforms, stored setups, and calibration constants are retained when there is no power to the oscilloscope.**

2 **Data is maintained by a lithium poly-carbon monofluoride battery.**

Nominal Traits

Nominal traits are described using simple statements of fact such as "Two, identical" for the trait "Input Channels, Number of," rather than in terms of limits that are performance requirements.

Table 1–10: Nominal traits — signal acquisition system

Name	Description	
Bandwidth Selections	20 MHz and FULL	
Digitizers, Number of	Two, identical, digitized simultaneously	
Digitized Bits, Number of	8 bits[1]	
Input Channels, Number of	Two, identical, called CH 1 and CH 2	
Input Coupling	DC, AC, or GND	
Ranges, Offset, All Channels	**Volts/Div setting**	**Offset range**
	2 mV/div – 99.5 mV/div	±1 V
	100 mV/div – 995 mV/div	±10 V
	1 V/div – 10 V/div	±100 V
Range, Position	±5 divisions	
Range, Sensitivity[2]	2 mV/div to 10 V/div	
Rise Time	TDS 340A: 3.5 ns TDS 360: 1.75 ns TDS 380: 875 ps	
TekProbe Interface	Level one probe coding	

1 **Displayed vertically with 25 digitization levels (DLs) per division and 10.24 divisions dynamic range with zoom off. A DL is the smallest voltage level change that the 8-bit A-D Converter can resolve, with the input scaled to the volts/division setting of the channel used. Expressed as a voltage, a DL is equal to 1/25 of a division times the volts/division setting.**

2 **The sensitivity ranges from 2 mV/div to 10 V/div in a 1–2–5 sequence of coarse settings. Between consecutive coarse settings, the sensitivity can be finely adjusted with a resolution of 1% of the more sensitive setting. For example, between 50 mV/div and 100 mV/div, the volts/division can be set with 0.5 mV resolution.**

Table 1–11: Nominal traits — time base system

Name	Description
Range, Sample-Rate[1,2]	TDS 340A: 10 Samples/s to 500 MSamples/s in a 1–2–5 sequence TDS 360: 10 Samples/s to 1 GSamples/s in a 1–2–5 sequence TDS 380: 10 Samples/s to 2 GSamples/s in a 1–2–5 sequence
Range, Seconds/Division	TDS 340A: 5 ns/div to 5 s/div in a 1–2.5–5 sequence TDS 360: 2.5 ns/div to 5 s/div in a 1–2.5–5 sequence TDS 380: 1 ns/div to 5 s/div in a 1–2.5–5 sequence
Range, Time Base Delay Time	16.5 ns to 50 seconds
Record Length	1,000 samples

1 **The range of real-time rates, expressed in samples/second, at which a digitizer samples signals at its inputs and stores the samples in memory to produce a record of time-sequential samples**

2 **The Waveform Rate (WR) is the equivalent sample rate of a waveform record. For a waveform record acquired by real-time sampling of a single acquisition, the waveform rate is the same as the real-time sample rate; for a waveform created by interpolation of real-time samples from a single acquisition or by equivalent-time sampling of multiple acquisitions, the waveform rate is faster than the real time sample rate. For all three cases, the waveform rate is 1/(Waveform Interval) for the waveform record, where the waveform interval (WI) is the time between the samples in the waveform record.**

Table 1–12: Nominal traits — triggering system

Name	Description	
Range, Hold Off	500 ns minimum to 10 seconds maximum	
Ranges, Trigger Level	**Source**	**Range**
	Any Channel	±12 divisions from center of screen
	External	±1.5 Volts
	External /10	±15 Volts
	Line	±300 Volts
Formats and Field Rates, Video Trigger	Triggers from sync-negative composite video, 525 to 625 lines, 50 Hz to 60 Hz, interlaced or noninterlaced systems with scan rates from 15 kHz to 65 kHz – such as NTSC, PAL, or SECAM	
TekProbe Interface, External Trigger	Level one probe coding	

Table 1–13: Nominal traits — display system

Name	Description
CRT Type	7-inch (17.95 cm) diagonal, magnetic deflection; horizontal raster-scan; P31 green phosphor
Video Display Resolution	640 pixels horizontally by 480 pixels vertically Display area is 5.04 inch (12.92 cm) horizontally by 3.78 inch (9.69 cm) vertically
Waveform Display Graticule	A single graticule 401 × 501 pixels (8 × 10 divisions, with divisions that are approximately 1 cm by 1 cm)
Intensity Levels	Dim and Bright, with adjustable Overall Intensity and Contrast

Table 1–14: Nominal traits — I/O interface option

Name	Description
GPIB	Part of Option 14 I/O interface or TD3F14A I/O interface field upgrade kit; complies with IEEE Std 488–1987
RS-232	Part of Option 14 I/O interface or TD3F14A I/O interface field upgrade kit; a 9-pin male DTE RS-232 interface that complies with EIA/TIA 574–90
Centronics	Part of Option 14 I/O interface or TD3F14A I/O interface field upgrade kit; a 25-pin, IBM PC-type, parallel printer interface that complies electrically with Centronics C332–44, Rev A
Video Signal Output (Option 14 Only)	DB-9 rear panel Video connector; non-interlaced, with levels that comply with ANSI RS343A VGA compatible at a 30.6 kHz sync rate
Power Supply, Printer (Option 14 Only)	Power supply connector to supply power to the Option 3P Printer Pack

Table 1–15: Nominal traits — power distribution system

Name	Description
Fuse Rating	5 mm × 20 mm, 3.15 A (T), 250 V; or 1.25 in × 0.25 in, 3 A (T), 250 V

Table 1–16: Nominal traits — mechanical characteristics

Name	Description
Weight	
Standard	7.0 kg (15.5 lbs) stand-alone instrument; 8.6 kg (19 lbs) with front cover, accessories, and accessories pouch installed; 12.9 kg (28.5 lbs) when packaged for domestic shipment
Rackmount	6.6 kg (14.5 lbs), plus weight of rackmount parts (Option 1R); 14.7 kg (32.5 lbs) when the oscilloscope is packaged for domestic shipment
Rackmount conversion kit	4.5 kg (10 lbs); 7.5 kg (17.5 lbs) when kit is packaged for domestic shipment
Overall Dimensions	
Standard Instrument (Figure 1–1)	Height: 191 mm (7.5 in) with feet and accessories pouch installed 165 mm (6.5 in) without the accessories pouch installed Width: 362 mm (14.25 in) with handle Depth: 471 mm (18.55 in) stand-alone instrument 490 mm (19.28 in) with front cover installed 564 mm (22.2 in) with handle extended
Rackmount Instrument	Height: 178 mm (7 in) Width: 483 mm (19 in) Depth: 472 mm (18.6 in) without handles; 517 mm (20.35 in) including handles

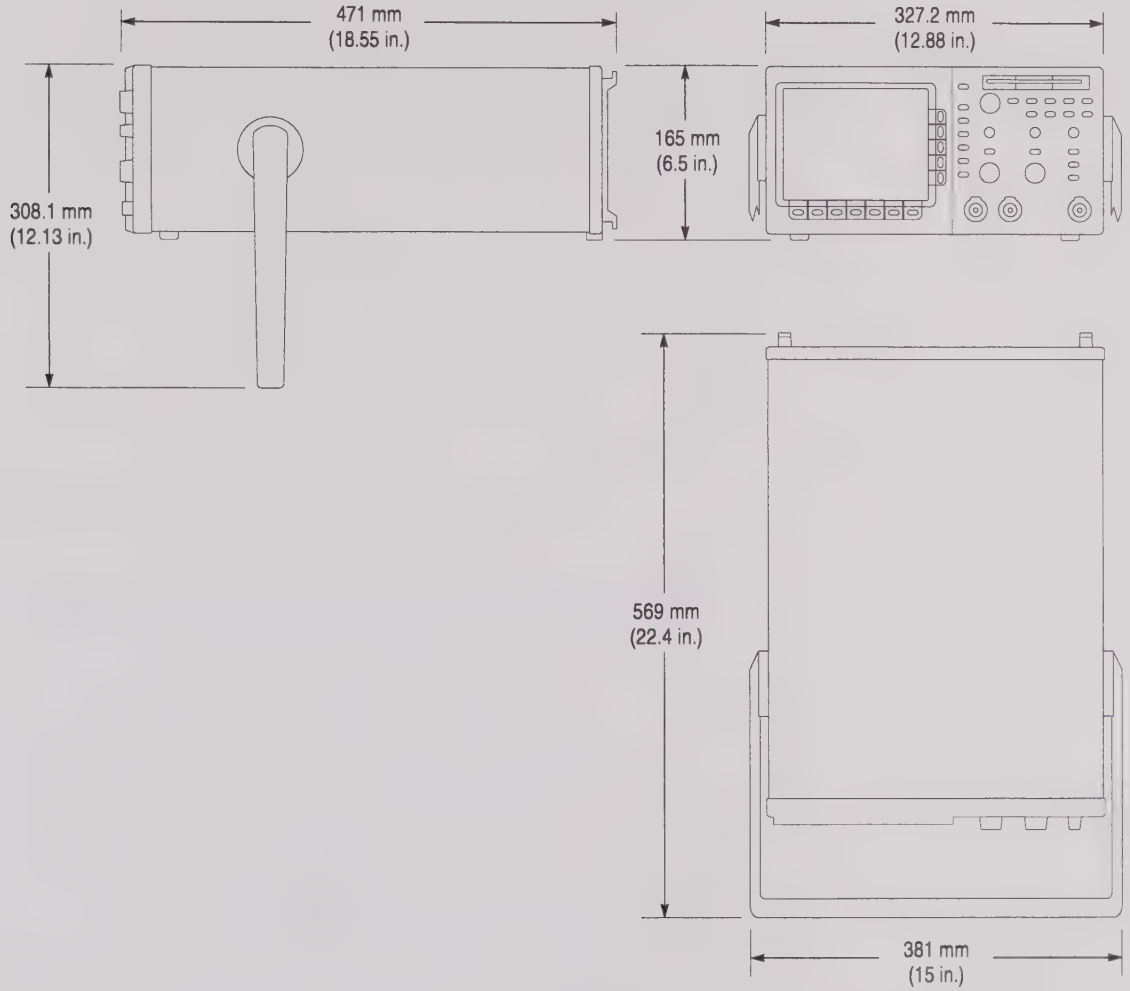


Figure 1–1: TDS 340A, TDS 360, & TDS 380 dimensions

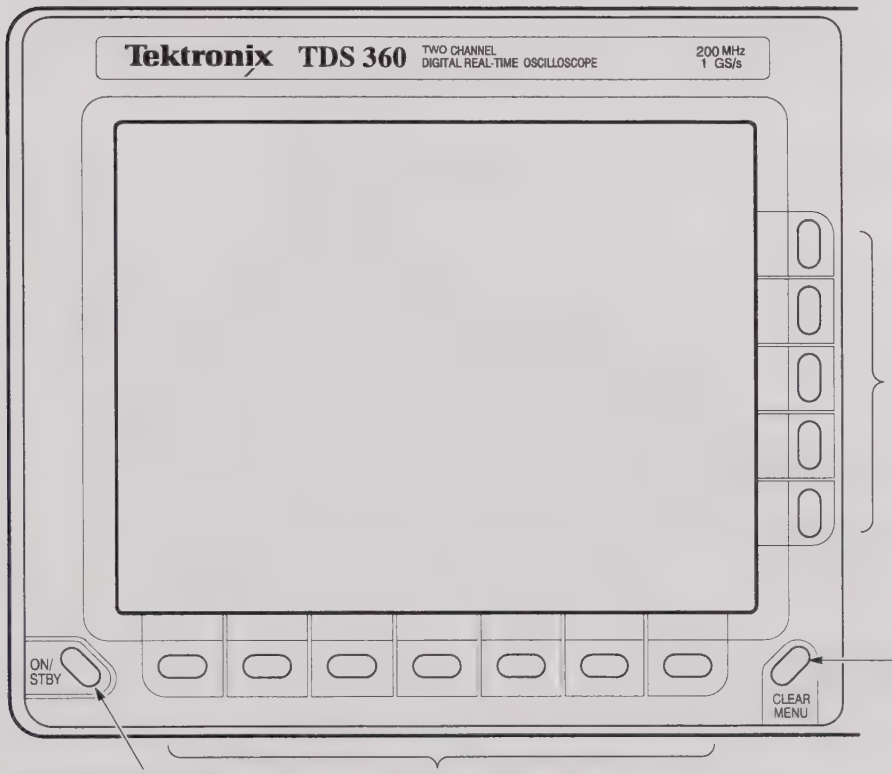
Table 1–17: Certifications and compliances

EC Declaration of Conformity	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/EEC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EMC Directive 89/336/EEC: EN 55011 — Class B Radiated and Conducted Emissions [1] EN 50081-1 Emissions: EN 60555-2 — AC Power Line Harmonic Emissions EN 50082-1 Immunity: IEC 801-2 — Electrostatic Discharge Immunity IEC 801-3 — RF Electromagnetic Field Immunity [2] IEC 801-4 — Electrical Fast Transient/Burst Immunity IEC 801-5 — Power Line Surge Immunity Low Voltage Directive 73/23/EEC: EN 61010-1 — Safety requirements for electrical equipment for measurement, control, and laboratory use 1 To maintain emission requirements when connecting to the I/O interface of this oscilloscope, use only a high-quality, double-shielded (braid and foil) cable. The cable shield must have low-impedance connections to both connector housings. The VGA cable must also have a ferrite core at both ends. Acceptable cables are listed in Table 7–6 on page 7–4. 2 Performance criteria: ≤±0.3 division waveform displacement, or ≤0.6 division increase in p-p noise from 27 MHz to 500 MHz. Test conditions: both channel inputs terminated with grounding caps, both channels set to 10 mV/div, both channels set to DC Coupling, trigger source set to CH 1, acquisition mode set to Sample, and time base set to 250 µs/div.
Certifications	Underwriters Laboratories listing to Standard UL3111–1 for Electrical Measuring and Test Equipment. [3] [4] Canadian Standards Association certified to Standard CAN/CSA-C22.2 No. 1010.1–92. [3] 3 These standards are North American interpretations of IEC 1010. 4 Conditions for certification: operating temperature –10° C to +55° C, maximum operating altitude 2000 m, Safety Class I (IEC 1010-1 Annex H), Overvoltage Catagory II (IEC 1010-1 Annex J), Pollution Degree 2 (IEC 1010-1).
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits
CSA Certified Power Cords	CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.
Overvoltage Category	Category: — Examples of Products in this Category: CAT III — Distribution-level mains, fixed installation CAT II — Local-level mains, appliances, portable equipment CAT I — Signal levels in special equipment or parts of equipment, telecommunications, electronics
Pollution Degree 2	Do not operate in environments where conductive pollutants may be present.

Operating Information

This section identifies and describes each control and connector on the TDS 300 Series oscilloscope. This chapter also describes how to use the oscilloscope menu system. Refer to the *TDS 340A, TDS 360 & TDS 380 User Manual* for more information on setting up and taking measurements with the oscilloscope.

Display and Power Controls



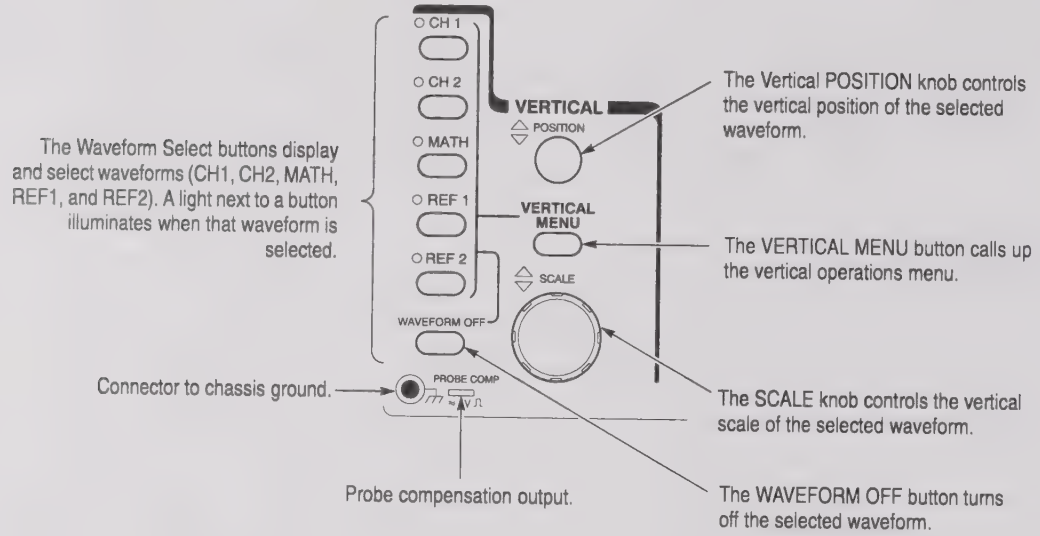
The Side Menu buttons provide access to side menu selections. Refer to page 2–7 for more information about the user interface Side Menu.

The CLEAR MENU button clears all menus from the screen.

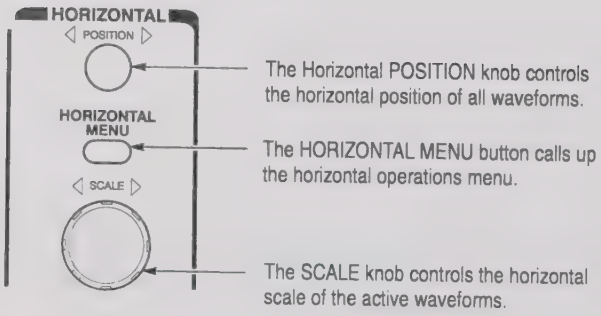
The ON/STBY button toggles instrument power.

The Main Menu buttons provide access to main menu selections. Refer to page 2–7 for more information about the user interface Main Menu.

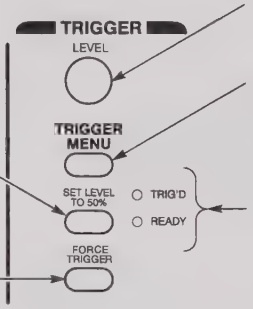
Vertical Controls


CH 1
CH 2
MATH
REF 1
REF 2
WAVEFORM OFF
VERTICAL
POSITION
VERTICAL MENU
SCALE
PROBE COMP
The Waveform Select buttons display and select waveforms (CH1, CH2, MATH, REF1, and REF2). A light next to a button illuminates when that waveform is selected.
The Vertical POSITION knob controls the vertical position of the selected waveform.
The VERTICAL MENU button calls up the vertical operations menu.
The SCALE knob controls the vertical scale of the selected waveform.
The WAVEFORM OFF button turns off the selected waveform.
Connector to chassis ground.
Probe compensation output.

Horizontal Controls


HORIZONTAL
POSITION
HORIZONTAL MENU
SCALE
The Horizontal POSITION knob controls the horizontal position of all waveforms.
The HORIZONTAL MENU button calls up the horizontal operations menu.
The SCALE knob controls the horizontal scale of the active waveforms.

Trigger Controls



The Trigger LEVEL knob controls the trigger.

The TRIGGER MENU button calls up the trigger menu.

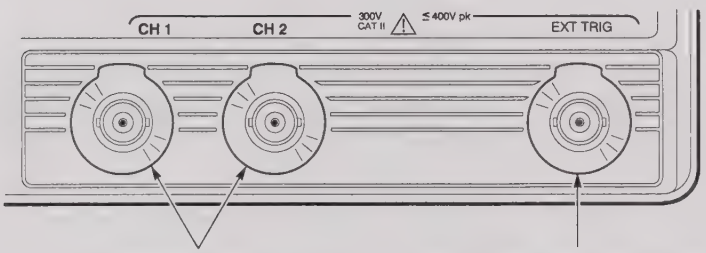
The SET LEVEL TO 50% button sets the trigger level at the midpoint between the peaks of the trigger signal.

The trigger status lights indicate the status of the triggering system. The TRIG'D light illuminates when the instrument recognizes a valid trigger.

The READY light illuminates when the instrument can accept a valid trigger and is waiting for that event to occur.

The FORCE TRIGGER button forces the oscilloscope to start acquiring a waveform regardless of whether a trigger event occurs. This button has no effect if the acquisition system is stopped.

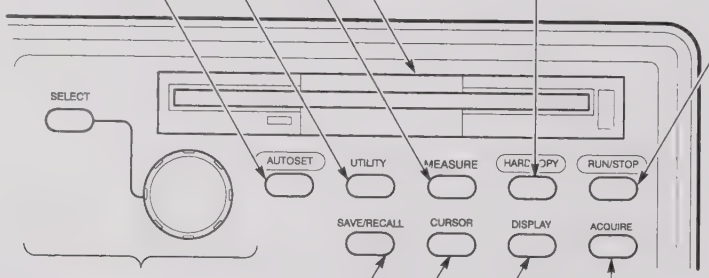
Inputs



The channel BNC inputs (CH1 and CH2) accept electrical signals for display.

The EXT TRIG input accepts external trigger signals.

Miscellaneous Controls



The MEASURE button calls up the automated measurements menu.

The UTILITY button calls up the utility menu.

The floppy disk drive provides mass storage for waveforms, setups, and hard copies.

The RUN/STOP button starts and stops acquisition.

The AUTOSET button automatically sets up the instrument to produce a usable display of the input signals.

The HARDCOPY button starts print operations. (Requires Opt 14 installed)

The General Purpose Knob controls many side-menu functions, including the cursors. The SELECT button switches control from cursor to cursor.

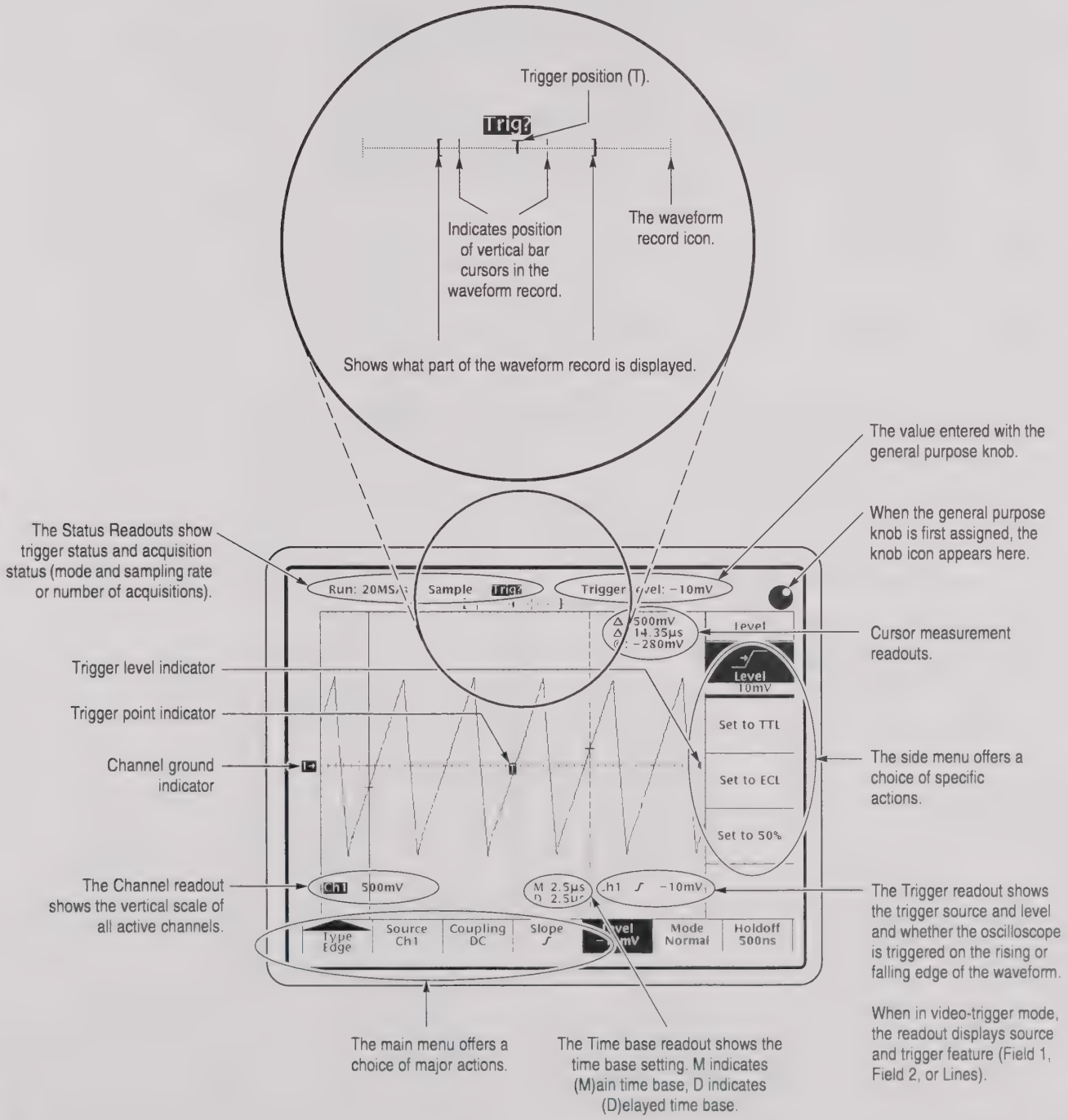
The ACQUIRE button calls up the acquisition menu.

The SAVE/RECALL button calls up the save/recall menu.

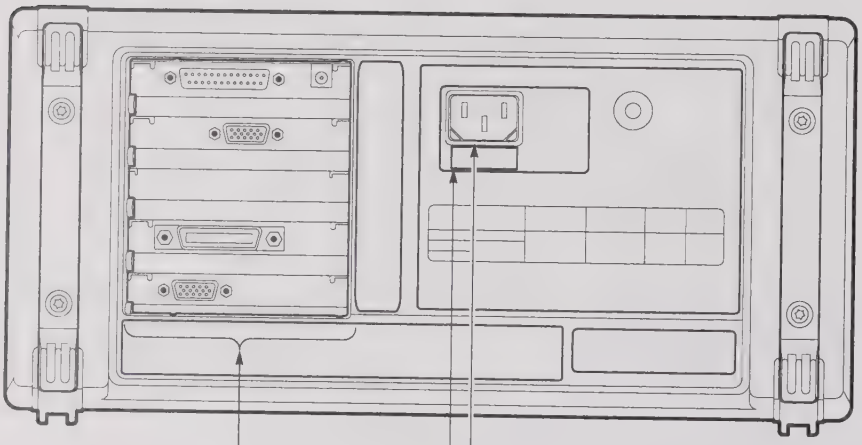
The CURSOR button calls up the cursor menu.

The DISPLAY button calls up the display menu.

Display Map


Trigger position (T).
Trig?
Indicates position of vertical bar cursors in the waveform record.
The waveform record icon.
Shows what part of the waveform record is displayed.
The value entered with the general purpose knob.
When the general purpose knob is first assigned, the knob icon appears here.
The Status Readouts show trigger status and acquisition status (mode and sampling rate or number of acquisitions).
Run: 20MS/s Sample Trig?
Trigger Level: −10mV
Δ 500mV
Δ 14.35µs
@: −280mV
Level
Cursor measurement readouts.
Trigger level indicator
Trigger point indicator
Channel ground indicator
Level 10mV
Set to TTL
Set to ECL
Set to 50%
The side menu offers a choice of specific actions.
The Channel readout shows the vertical scale of all active channels.
Ch1 500mV
M 2.5µs
D 2.5µs
Ch1 ∫ −10mV
The Trigger readout shows the trigger source and level and whether the oscilloscope is triggered on the rising or falling edge of the waveform.
When in video-trigger mode, the readout displays source and trigger feature (Field 1, Field 2, or Lines).
Type Edge
Source Ch1
Coupling DC
Slope ∫
Level −10mV
Mode Normal
Holdoff 500ns
The main menu offers a choice of major actions.
The Time base readout shows the time base setting. M indicates (M)ain time base, D indicates (D)elayed time base.

Rear-Panel Connectors



The Option 14 Panel (Option 14 instruments only) allows access to three communications interfaces: a Centronics parallel port, an RS-232 interface, and a GPIB interface. It also includes a VGA video-compatible output port and a power connector for the optional TDS4F5P printer upgrade kit.

You can use the Centronics, RS-232, and GPIB interfaces to transmit hardcopy data.

You can use the GPIB and RS-232 interfaces to operate and program the oscilloscope from a GPIB or RS-232 controller; see the *TDS 340A, TDS 360 & TDS 380 Programmer Manual* for more information.

The power connector accepts line voltage to power the instrument. Refer to page 7–2 for a list of power cord and connector options.

The fuse drawer holds the line fuse. Refer to page 6–8 for fuse replacement procedures.

Using the Menu System

TDS 300 Series oscilloscopes use an intuitive user interface. This interface reduces front-panel clutter while allowing easy access to specialized functions through the menu structure.

The following procedure describes how to navigate in the menu structure. If you are unfamiliar with this menu system, you may want to run through the procedure several times to learn how you can access functions and subfunctions. Figure 2–2 provides a graphic overview of using the menu system.

1. Push a front-panel button to call up a menu of functions. This first menu is the *main menu*. Sometimes the main menu will be a side menu (step 3), but most main menus are bottom menus.

2. Push a main menu button to select a function. One of three things happens:

   - If the function has no subfunctions, it becomes active. If it is a variable function, you can now use the General Purpose Knob to adjust it (step 4).
   - If the function has subfunctions, they appear on the side menu (step 3).
   - The leftmost main menu button sometimes activates a pop-up menu (as shown in Figure 2–1). You can cycle through the pop-up menu options by repeatedly pressing the button. Each selection calls up different main and side menus.

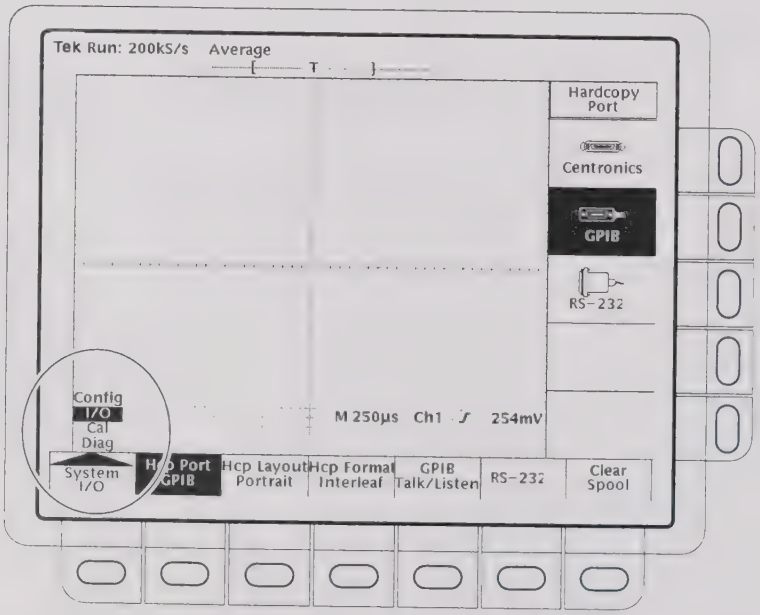
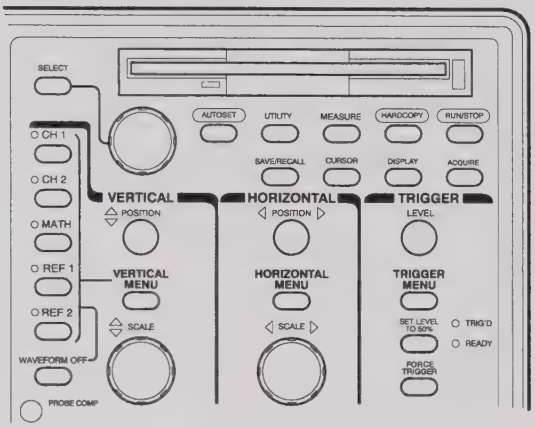


Figure 2–1: A pop-up menu

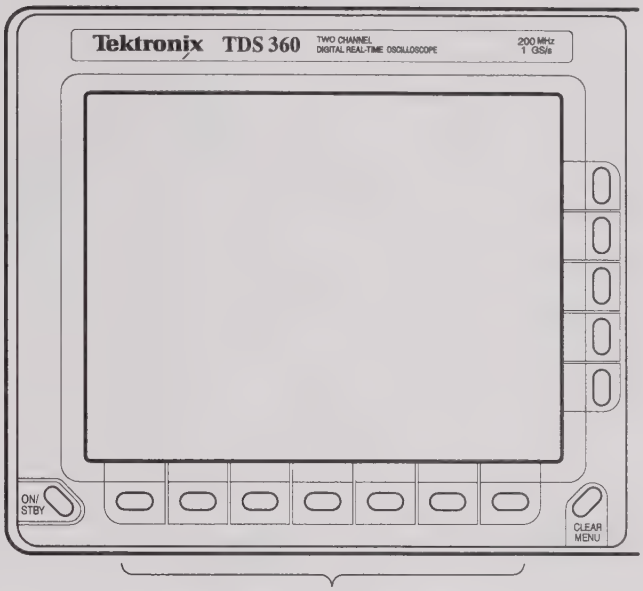
3. Push a side-menu button to select a subfunction.

4. Use the General Purpose knob to change variable-function or subfunction settings.

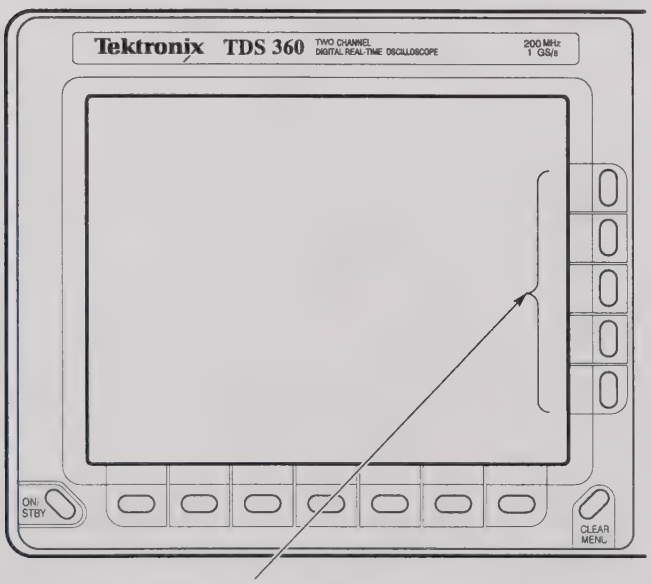
5. Press the CLEAR MENU button to remove a menu from the screen.



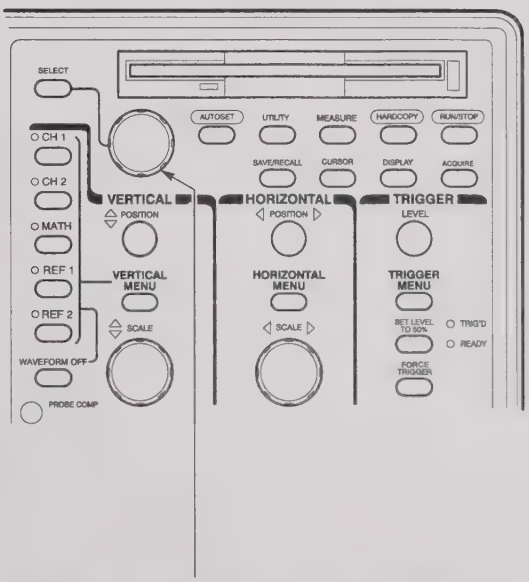
1 Press any of the front-panel menu buttons.



2 Select an item from the main menu or use leftmost button to pop up selections.



3 Select an item from the side menu, if displayed.



4 Adjust menu item values with general purpose knob.

Figure 2–2: Using menus

Theory of Operation

This section describes the electrical operation of the TDS 340A, TDS 360, and TDS 380 to the module level.

Logic Conventions

This manual refers to digital logic circuits with standard logic symbols and terms. Unless otherwise stated, all logic functions are described using the positive logic convention: the more positive of the two logic levels is the high (1) state and the more negative level is the low (0) state. Signal states may also be described as "true" meaning their active state or "false" meaning their non-active state. The specific voltages that constitute a high or low state vary among the electronic devices.

Active-low signals are indicated by a tilde (~) prefixed to the signal name (~RESET). Signal names are considered to be either active-high, active-low, or to have both active-high and active-low states.

Module Overview

This overview describes the basic operation of each functional circuit block as shown in Figures NO TAG through 3–2.

Input Signal Path

A signal enters the oscilloscope through a probe connected to a BNC on the A11 (TDS 340A), A12 (TDS 360), or A13 (TDS 380) Main Board.

Attenuators. Circuitry in the attenuator selects the input coupling and attenuation factor. The processor system controls the attenuators with a serial interface.

Probe Coding Interface. The probe coding interface signals pass through the Main Board to the A6 Front Panel, which senses them.

Acquisition System. The acquisition system amplifies the input signals, samples them, converts them to digital signals, and controls the acquisition process under direction of the processor system. The acquisition system includes the trigger, acquisition timing, and acquisition mode generation and control circuitry.

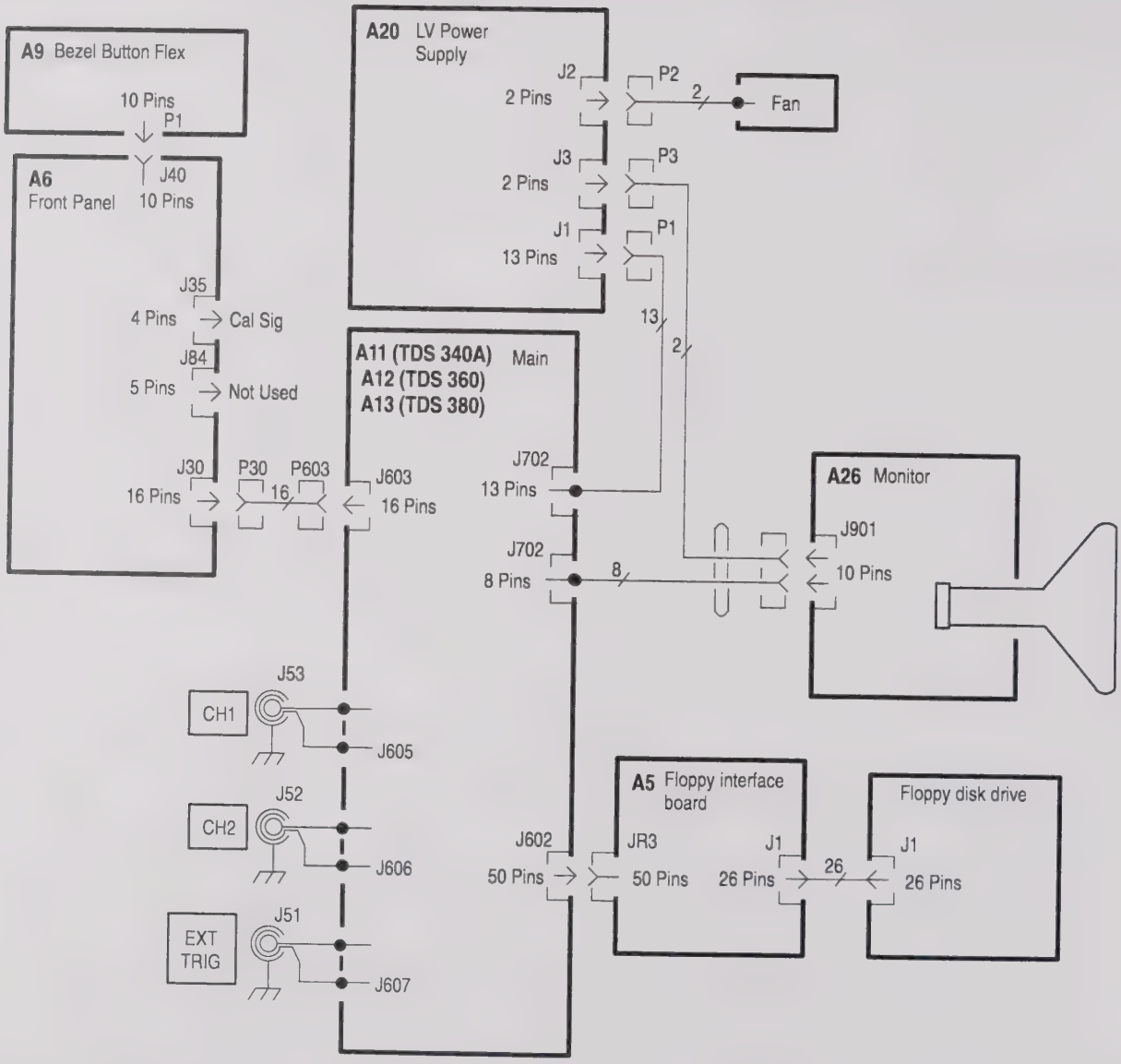


Figure 3–1: TDS 340A, TDS 360, & TDS 380 block diagram

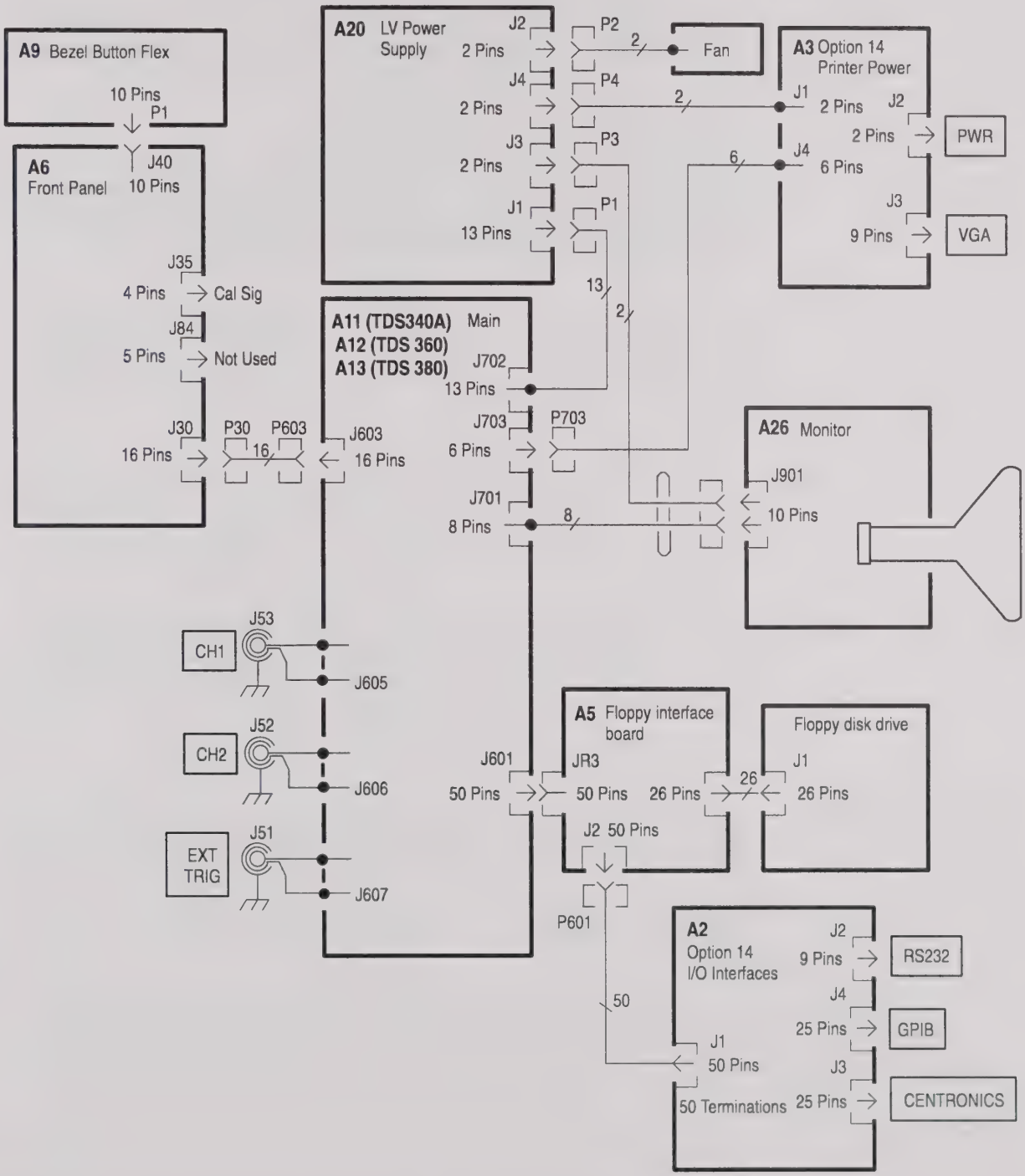


Figure 3–2: TDS 340A, TDS 360, and TDS 380 with Option 14 block diagram

Processor System. The processor system contains a 68331 microprocessor that controls the entire instrument. The processor passes waveforms and text on to the display system. The Main Board contains both the processor and display systems, in addition to the firmware ROMs.

Display System. A display controller IC processes text and waveforms. The display system sends the text and waveform information to the monitor assembly as a video signal. The display system also generates and sends vertical (VSYNC) and horizontal (HSYNC) sync signals to the monitor assembly.

Monitor

All information (waveforms, text, graticules, and pictographs) is displayed by the A26 Monitor. It generates the high voltages necessary to drive the display tube. It also contains the video amplifier, horizontal oscillator, and the vertical and horizontal yoke driver circuitry.

Front Panel

The processor system sends instructions to and receives information from the Front Panel Processor on the Front Panel Board. The Front Panel Processor reads the front-panel switches and ports, and reports any change in their settings to the processor system. The Front Panel Processor also turns front panel LEDs on and off.

The Front Panel Processor reads the front-panel menu switches and sends any changes in menu selections to the processor system. The **ON/STBY** button is not read by the Front Panel Processor but passes through the Front Panel Board and the Main Board to the A20 Low Voltage Power Supply.

The front panel also generates the probe compensation signal.

Floppy Disk Drive

The floppy disk drive system consists of the A5 floppy interface board that connects to the main board. A 26-pin cable connects the floppy disk drive to the floppy interface board, supplying both power and data to the drive.

The drive is 2 Mbyte double-side, high-density unit that uses 3.5 inch IBM-format disks.

Option 14

The A2 Option 14 board has GPIB, RS-232, and Centronics interfaces for external control and hardcopy operations. Also included is the A3 board with a VGA video output port and a power connector for the Option 3P printer.

Low Voltage Power Supply

The A20 Low Voltage Power Supply is a switching power converter. It supplies power to all the circuitry in the oscilloscope.

The Low Voltage Power Supply does not have a main power switch. The **ON/STBY** switch, located on the front panel, controls all the power to the oscilloscope except the standby circuits in the Low Voltage Power Supply.

Fan

The fan provides forced air cooling for the oscilloscope. It connects to a 12 V connector on the Low Voltage Power Supply.

Performance Verification

The procedures in this section verify that the TDS 340A, TDS 360, and TDS 380 oscilloscopes meet warranted specifications. There are three performance tests that you can do.

- To rapidly confirm that this oscilloscope functions, do the *Self Test* procedures that begin on page 4–5.

  Advantages: This procedure is quick to do, requires no external equipment or signal sources, and performs extensive functional and accuracy testing to provide high confidence that the oscilloscope performs properly. You can use it as a quick check before making a series of important measurements.

- To further check functionality, do the *Functional Test* procedures that begin on page 4–7.

  Advantages: These procedures require minimal additional time to perform, require no additional equipment other than a standard-accessory probe, and more completely test the internal hardware of this oscilloscope. You can use them to quickly determine if the oscilloscope is suitable for putting into service, such as when it is first received.

- If you need a more extensive confirmation of performance, do the *Performance Tests* that begin on page 4–11, after doing the functional and self tests.

  Advantages: These procedures check warranted specifications. They require more time and suitable test equipment. (See *Test Equipment* on page 4–3.)

Conventions

Throughout these procedures the following conventions apply:

- Each test procedure uses the following general format:

  Title of test
  Equipment required
  Time required
  Prerequisites
  Procedure steps

- Refer to Figure 4–1: "Main menu" refers to the menu that labels the seven menu buttons under the display. "Side menu" refers to the menu that labels the five buttons to the right of the display. "Pop-up menu" refers to a menu that pops up when a main menu button is pressed.
- Where instructed to use a front-panel button or knob, select from a main or side menu, or verify a readout or status message, the name of the button or knob appears in boldface type.
- Instructions for menu selection follow this format: **FRONT PANEL BUTTON → Pop-Up (if necessary) → Main Menu Button → Side Menu Button**. For example, "Push **TRIGGER MENU → Type: Video → Trigger On → Lines**."

STOP. *This symbol denotes information you must read to do the procedure properly.*

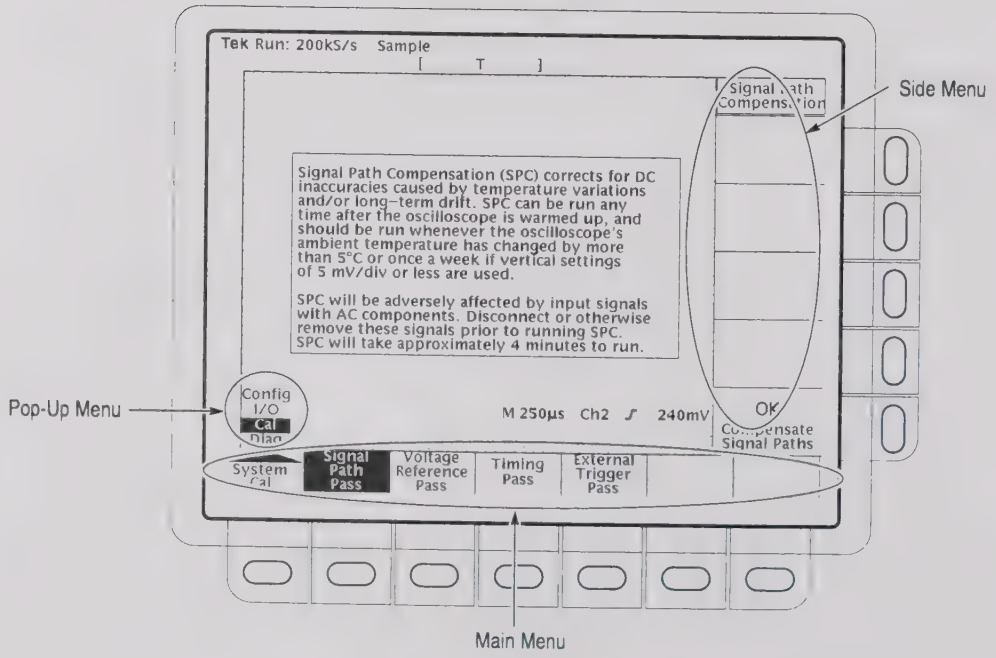

Tek Run: 200kS/s Sample
Signal Path Compensation (SPC) corrects for DC inaccuracies caused by temperature variations and/or long-term drift. SPC can be run any time after the oscilloscope is warmed up, and should be run whenever the oscilloscope's ambient temperature has changed by more than 5°C or once a week if vertical settings of 5 mV/div or less are used.
SPC will be adversely affected by input signals with AC components. Disconnect or otherwise remove these signals prior to running SPC. SPC will take approximately 4 minutes to run.
Side Menu
Pop-Up Menu
Config
I/O
Cal
M 250µs Ch2 240mV
OK
Compensate Signal Paths
System Cal
Signal Path Pass
Voltage Reference Pass
Timing Pass
External Trigger Pass
Main Menu

Figure 4–1: Menu locations

Test Equipment

The performance test procedures require external, traceable signal sources to check instrument performance. If your test equipment does not meet the minimum requirements listed in Table 4–1, your test results will be invalid.

Table 4–1: Test equipment

Item number and description	Minimum requirements	Example	Purpose
1. Termination 50 Ω (two required)	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0049-01	Checking delay between channels
2. Cable, Precision Coaxial (two required)	50 Ω, 91 cm (36 in), male to male BNC connectors	Tektronix part number 012-0482-00	Signal interconnection
3. Connector, Dual-Banana	Female-BNC to dual-banana	Tektronix part number 103-0090-00	Several accuracy tests
4. Connector, BNC "T"	Male-BNC to dual-female-BNC	Tektronix part number 103-0030-00	Checking trigger sensitivity
5. Coupler, Dual-Input	Female-BNC to dual-male-BNC	Tektronix part number 067-0525-02	Checking delay between channels
6. Generator, DC Calibration	Variable amplitude to ±110 V; accuracy to 0.1%	Wavetek 9100 Calibration System with Option 250 and Option 100	Checking DC offset, gain, and measurement accuracy
7. Generator, Leveled Sine Wave, Medium-Frequency	50 kHz to 250 MHz; variable amplitude from 5 mV to 4 V_{p-p} into 50 Ω	Wavetek 9100 Calibration System with Option 250 and Option 100	Checking bandwidth and trigger sensitivity
8. Generator, Leveled Sine Wave, High-Frequency[1]	50 kHz to 400 MHz; variable amplitude from 5 mV to 4 V_{p-p} into 50 Ω	Rohde & Schwarz SMY with URV 35 Power Meter and NRV-Z8 Power Sensor	Checking bandwidth and trigger sensitivity
9. Generator, Time Mark	Variable marker frequency from 10 ms to 10 ns; accuracy within 2 ppm	Wavetek 9100 Calibration System with Option 250 and Option 100	Checking sample rate and delay-time accuracy
10. Probe, 10X, included with this instrument	A P6109B (TDS 340A), P6111B (TDS 360), or P6114B (TDS 380) probe	Tektronix number P6109B (TDS 340A), P6111B (TDS 360), or P6114B (TDS 380)	Signal interconnection

[1] **The high frequency leveled sine wave generator is only required to verify the TDS 380, not the TDS 340A or TDS 360. If you use the example equipment, refer to *Sine Wave Generator Leveling Procedure* on page 4–20 for information on obtaining a leveled output from an unleveled sine wave generator. If available, you can use a Tektronix SG504 Leveled Sine Wave Generator in place of the example equipment.**

Test Record

Photocopy this page and use it to record the performance test results for your instrument.

TDS 340A, TDS 360, and TDS 380 test record

Instrument Serial Number: _____ Certificate Number: _____
Temperature: _____ RH %: _____
Date of Calibration: _____ Technician: _____

Performance test		Minimum	Incoming	Outgoing	Maximum
DC Voltage Measurement Accuracy					
CH1 VOLTS/DIV 1 V		+97.1 V	_____	_____	+98.9 V
	200 mV	+8.28 V	_____	_____	+8.52 V
	50 mV[1]	–581 mV	_____	_____	–619 mV
	50 mV[2]	–881 mV	_____	_____	–919 mV
	Δ at 50 mV	+286 mV	_____	_____	+314 mV
	10 mV	+54.6 mV	_____	_____	+65.4 mV
	5 mV	–982 mV	_____	_____	–998 mV
CH2 VOLTS/DIV 1 V		+97.1 V	_____	_____	+98.9 V
	200 mV	+8.28 V	_____	_____	+8.52 V
	50 mV[1]	–581 mV	_____	_____	–619 mV
	50 mV[2]	–881 mV	_____	_____	–919 mV
	Δ at 50 mV	+286 mV	_____	_____	+314 mV
	10 mV	+54.6 mV	_____	_____	+65.4 mV
	5 mV	–982 mV	_____	_____	–998 mV
Analog bandwidth					
CH1		42.5 mV	_____	_____	N/A
CH2		42.5 mV	_____	_____	N/A
Long term sample rate and delay time accuracy					
		–2.0 Div	_____	_____	+2.0 Div
Edge trigger sensitivity, DC coupled					
Main Trigger		stable trigger	_____	_____	N/A
Main Trigger – Falling		stable trigger	_____	_____	N/A

1 **Generator set at –0.6 V.**
2 **Generator set at –0.9 V.**

Self Test

This procedure uses internal routines to verify that the oscilloscope functions and passes its internal self tests and signal-path compensations. It also confirms that the oscilloscope was adjusted properly at the time it was last adjusted. No test equipment or hookups are required.

Equipment Required: None.

Time Required: Approximately 5 minutes.

Prerequisites: Power up the oscilloscope and allow a 20 minute warm up before doing this procedure.

Procedure:

1. Press the front-panel button **UTILITY**.
2. Press the main-menu button **System** to select **Diag**.
3. Press the main-menu button **Execute** and then press the side-menu button **OK Confirm Run Test**. The internal diagnostics verify proper oscilloscope function. This verification takes about 30 seconds. While it progresses, a variety of test patterns flash on screen. When finished, status messages appear on the screen.
4. Check that the screen reports no failures. If it reports a failure, the oscilloscope has failed the self test. Contact your Tektronix representative for assistance.
5. Press **CLEAR MENU**.
6. Press **UTILITY** and then press the main-menu button **System** to select **Cal**.
7. Check that the word **Pass** appears in the main menu under the Voltage Reference, Timing, and Ext Trig menu labels. (See Figure 4–2.) If any of the labels read Fail, the oscilloscope has failed the self test. Contact your Tektronix representative for assistance.

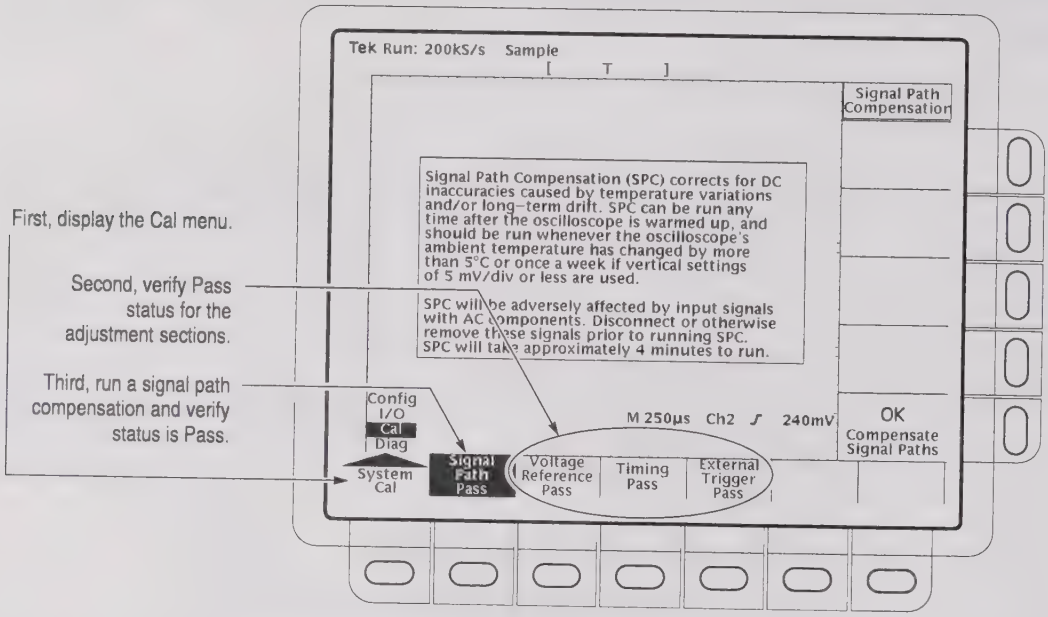

First, display the Cal menu.
Second, verify Pass status for the adjustment sections.
Third, run a signal path compensation and verify status is Pass.
Tek Run: 200kS/s Sample
[T]
Signal Path Compensation
Signal Path Compensation (SPC) corrects for DC inaccuracies caused by temperature variations and/or long-term drift. SPC can be run any time after the oscilloscope is warmed up, and should be run whenever the oscilloscope's ambient temperature has changed by more than 5°C or once a week if vertical settings of 5 mV/div or less are used.
SPC will be adversely affected by input signals with AC components. Disconnect or otherwise remove these signals prior to running SPC. SPC will take approximately 4 minutes to run.
Config
I/O
Cal
Diag
System Cal
Signal Path Pass
M 250µs Ch2 ƒ 240mV
Voltage Reference Pass
Timing Pass
External Trigger Pass
OK
Compensate Signal Paths

Figure 4–2: Verifying adjustments and signal path compensation

8. Press **Signal Path** and then press the side menu button **OK Compensate Signal Paths**. When compensation completes, the status message updates to Pass or Fail in the main menu

9. Check that the word **Pass** appears under **Signal Path** in the main menu. (See Figure 4–2.) If Pass does not appear, the oscilloscope has failed the performance verification; return it to Tektronix for servicing.

Functional Test

This procedure confirms that the oscilloscope functions properly.

NOTE. *This procedure verifies functions; that is, it verifies that oscilloscope features operate. It does not verify that they operate within limits. Therefore, when the instructions that follow call for you to verify that a signal appears on-screen "that is about five divisions in amplitude" or "has a period of about six horizontal divisions," do NOT interpret the quantities given as limits. Operation within limits is checked in the performance tests, which begin on page 4–11.*

DO NOT make changes to the front-panel settings that are not called out in the procedure. If you make changes to these settings other than those called out in the procedure, you may obtain invalid results. In this case, just redo the procedure from step 1.

Equipment Required: One P6109B (TDS 340A), P6111B (TDS 360), or P6114B (TDS 380) probe.

Time Required: Approximately 5 minutes.

Prerequisites: None.

Procedure:

1. Install the probe on **CH 1**. Connect the probe tip to **PROBE COMP** on the front panel; leave the probe ground unconnected. (See Figure 4–3.)

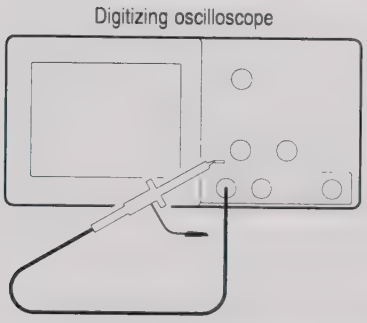


Figure 4–3: Hookup for functional test

2. Press the front-panel button **SAVE/RECALL**, the main-menu button **Recall Factory Setup**, and then the side-menu button **OK Confirm Factory Init.**

3. Press **AUTOSET**.
4. Set the **VOLTS/DIV** to 1 V. Use the vertical **POSITION** knob to center the waveform vertically on screen.
5. Set the **SEC/DIV** to 250 µs. Check that a square wave probe-compensation signal of about five divisions in amplitude is on screen.
6. Check that one period of the square wave probe-compensation signal is about four horizontal divisions on screen.
7. Check that the horizontal **POSITION** knob positions the signal left and right on screen when rotated.
8. Press the front-panel button **TRIGGER MENU**, the main-menu button **Mode**, and then the side-menu button **Normal**.
9. Check that the trigger-level readout for the main trigger system changes with the trigger **LEVEL** knob.
10. Check that the trigger-level knob can trigger and untrigger the square-wave signal as you rotate it. (Leave the signal untriggered.)
11. Check that pressing **SET LEVEL TO 50%** triggers the signal that you just left untriggered.
12. Press the front-panel button **ACQUIRE**, the main-menu button **Mode**, and then the side-menu button **Sample**.
13. Check that the oscilloscope displays an actively acquiring waveform. (Note that there is noise present on the peaks of the square wave.)
14. Press the side-menu button **Peak Detect**. Check that the oscilloscope displays an actively acquiring waveform with the noise "peak detected."
15. Press the side-menu button **Envelope**. Check that the oscilloscope displays an actively acquiring waveform with the noise displayed.
16. Press the side-menu button **Average**. Check that the oscilloscope displays an actively acquiring waveform with the noise reduced.
17. Press **WAVEFORM OFF** to remove Channel 1 from the display.
18. Press CH 2 and move the probe to the CH 2 input.
19. Repeat steps 3 through 16 for Channel 2.
20. Disconnect the probe from the channel input and the PROBE COMP terminal. You are done running the oscilloscope functional test.

File System Functional Test

Equipment Required: One 720K or 1.44Mbyte, 3.5 inch DOS-compatible disk (formatted).

Time Required: Approximately 5 minutes.

Prerequisites: None.

Procedure:

1. Install the probe on **CH 1**. Connect the probe tip to **PROBE COMP** on the front panel; leave the probe ground unconnected. (See Figure 4–4.)

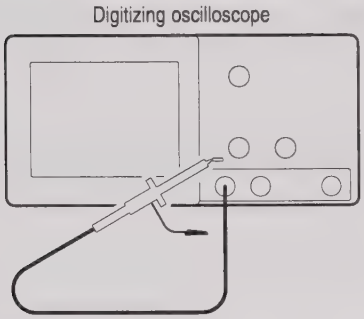


Figure 4–4: Hookup for file system functional test

2. Insert the disk in the disk drive.
3. Push the **SAVE/RECALL** front-panel button.
4. Push the **Recall Factory Setup** main-menu button.
5. Push the **OK Confirm Factory Init** side-menu button.
6. Push the trigger **SET LEVEL TO 50%** front-panel button.
7. Set the horizontal **SCALE** to 250 µs.
8. Push the **Save Current Setup** main-menu button.
9. Push the **To File** side-menu button.
10. Turn the general purpose knob to select the file to which to save the current settings. Select TEK?????.SET. This saves the settings to a file starting with TEK, then containing five digits, and a .SET extension. For example, if you are using a blank disk, the file name will be TEK00000.SET.
11. Push the **Save To Selected File** side-menu button. The oscilloscope writes the current settings out to the file.

12. Push the **SAVE/RECALL** front-panel button.

13. Push the **Recall Factory Setup** main-menu button.

14. Push the **OK Confirm Factory Init** side-menu button. This restores the oscilloscope settings to those before you saved the settings.

15. Push the **Recall Saved Setup** main-menu button.

16. Push the **From File** side-menu button.

17. Turn the general purpose knob to select the file to which you saved the settings (step 10). If you used a blank floppy disk, this file is TEK00000.SET.

18. Push the **Recall From Selected File** side-menu button. The oscilloscope reads the current settings from the selected file and resets its settings. The displayed signal should show a horizontal setting of 250 µs and the trigger at 50%.

19. Disconnect the probe from the channel input and the PROBE COMP terminal. You are done running the file system functional test.

Performance Tests

These procedures confirm that the oscilloscope functions within warranted limits.The procedures are in three groupings: *Signal Acquisition System Checks, Time Base System Checks,* and *Trigger System Checks*. They check all the characteristics that appear in **boldface** type under *Warranted Characteristics* on page 1–1.

Prerequisites

The tests in this subsection comprise an extensive, valid confirmation of performance and functionality when the following requirements are met:

- The cabinet must be installed.
- You must have performed and passed the procedures under *Self Test,* on page 4–5, and those under *Functional Test,* on page 4–7.
- The oscilloscope must have been operating for a warm-up period of at least 20 minutes, and must be operating at an ambient temperature between –10° C and +55° C.

Signal Acquisition System Checks

These procedures check signal acquisition system characteristics that are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check DC Voltage Measurement Accuracy

WARNING. *Performance of this procedure requires input voltages up to 98 VDC. Contact with live circuits could cause injury or death. Be sure to set the DC calibration generator to 0 volts before connecting, disconnecting, or moving the test hookup during the performance of this procedure.*

Equipment Required: One dual-banana connector (Item 3), one DC calibration generator (Item 6), and one precision coaxial cable (Item 2).

Time Required: Approximately 35 minutes.

Prerequisites: The oscilloscope must meet the prerequisites listed on page 4–11.

Procedure:

1. Set the output of a DC calibration generator to 0 volts.
2. Connect the output of a DC calibration generator through a dual-banana connector followed by a 50 Ω precision coaxial cable to **CH 1**, as shown in Figure 4–5.

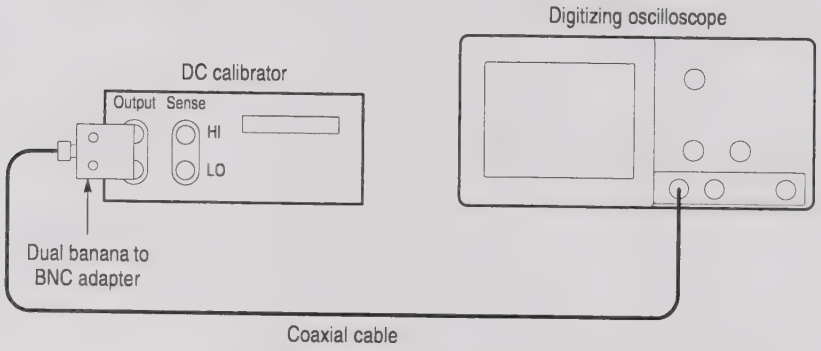


Figure 4–5: Hookup for DC voltage measurement accuracy check

3. Press **SAVE/RECALL SETUP → Recall Factory Setup → OK Confirm Factory Init**.
4. Press **ACQUIRE → Mode → Average 16**.
5. Press **MEASURE → Select Measurement**.
6. Press the side menu button **more** until the menu label **Mean** appears in the side menu. Press the side menu button **Mean**.
7. Set the vertical **SCALE** to one of the settings listed in Table 4–2 that you have not yet checked. (Start with the first setting listed.)
8. Press **VERTICAL MENU → Position**.
9. Turn the **General Purpose Knob** to set the vertical position to the setting listed in Table 4–2. The baseline level moves off screen.
10. Press the main menu button **Offset**.

11. Use the **General Purpose Knob** to set vertical offset to the setting listed in Table 4–2 for the present vertical scale setting. The baseline level remains off screen.

Table 4–2: DC accuracy

Vertical scale setting	Position setting (divs)	Offset setting	Generator setting	Accuracy limits
1 V	+5	+100 V	+98 V	+97.1 V to +98.9 V
200 mV	+5	+10 V	+8.4 V	+8.28 V to +8.52 V
50 mV	–5	–1 V	–0.6 V	–581 mV to –619 mV
50 mV	–5	–1 V	–0.9 V	–881 mV to –919 mV
Δ at 50 mV				+286 mV to +314 mV
10 mV	–5	0 V	+60 mV	+54.6 mV to +65.4 mV
5 mV	0	–1 V	–990 mV	–982 mV to –998 mV

12. Set the generator to the level and polarity indicated in Table 4–2 for the vertical scale, position, and offset settings you have made. The DC test level should appear on screen. (If it does not return, the DC accuracy check has failed for the present vertical scale setting of the current channel.)

13. Check that the readout for the measurement **Mean** readout on screen is within the limits listed for the present vertical scale and position/offset/generator settings.

14. Repeat steps 7 through 13 until you have checked all the vertical scale settings listed in Table 4–2. Record the measurements for each of the 50 mV settings.

15. Subtract the second 50 mV measurement from the first and compare the result to the "Δ at 50 mV" limits in Table 4–2.

16. Press **WAVEFORM OFF**; then, press **CH 2**.

17. Set the generator output to 0 V.

18. Move the test hookup to the **CH 2** input.

19. Repeat steps 5 through 15 for channel 2.

20. Set the generator output to 0 V.

21. Disconnect the cable at the **CH 2** input connector.

DC Gain Accuracy

DC gain accuracy is verified by successful completion of the self tests and the DC voltage measurement accuracy (in the previous procedure).

Offset Accuracy

Offset accuracy is verified by successful completion of the self tests and the DC voltage measurement accuracy (in the previous procedure).

Check Analog Bandwidth

Equipment Required: One leveled sine wave generator (Item 7 or 8), one 50 Ω precision cable (Item 2), and one 50 Ω termination (Item 1).

Time Required: Approximately 20 minutes.

Prerequisites: See page 4–11.

Procedure:

1. Connect, through a 50 Ω precision cable and a 50 Ω termination, the sine wave output of a leveled sine wave generator to **CH 1** (see Figure 4–6). Set the output of the generator to a reference frequency of 50 kHz.

NOTE. *If you are verifying a TDS 380, you need a leveled sine wave generator with a 400 MHz output frequency. Refer to* Sine Wave Generator Leveling Procedure *on page 4–20 for information on obtaining a leveled output from an unleveled sine wave generator.*

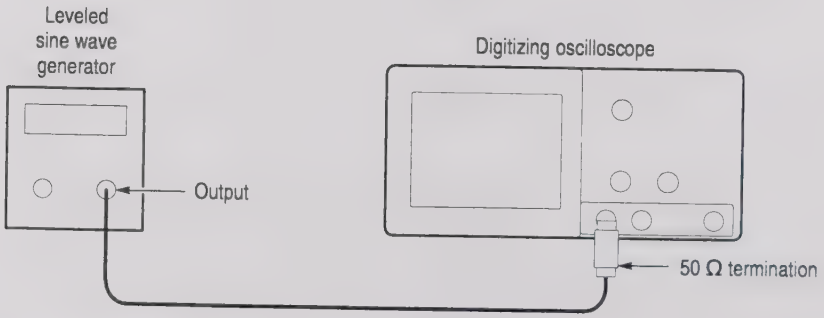


Figure 4–6: Hookup for analog bandwidth check

1. Press **SAVE/RECALL SETUP → Recall Factory Setup → OK Confirm Factory Init**.
2. Set the horizontal **SCALE** to 10 µs/div.
3. Press **TRIGGER MENU → Coupling → Noise Rej**.
4. Press **ACQUIRE → Mode → Average 16**.

5. Press **MEASURE → High-Low Setup → Min-Max**.
6. Press the main menu button **Select Measurement**. Now press the side menu button **more** until the menu label **Pk-Pk** appears in the side menu. Press the side menu button **Pk-Pk**.
7. Set the vertical **SCALE** to 10 mV/div.
8. Set the generator output so the **CHx Pk-Pk** readout equals 60 mV.
9. Press **SET LEVEL TO 50%** as necessary to trigger the display.
10. Increase the frequency of the generator output to 100 MHz (TDS 340A), 200 MHz (TDS 360), or 400 MHz (TDS 380).
11. Set the horizontal **SCALE** to 5 ns/div (TDS 340A), 2.5 ns/div (TDS 360), or 2.5 ns/div (TDS 380).
12. Press **SET LEVEL TO 50%** as necessary to trigger the display.
13. Check that the **Pk-Pk** readout on screen (as shown in Figure 4–7) is ≥ 42.5 mV.

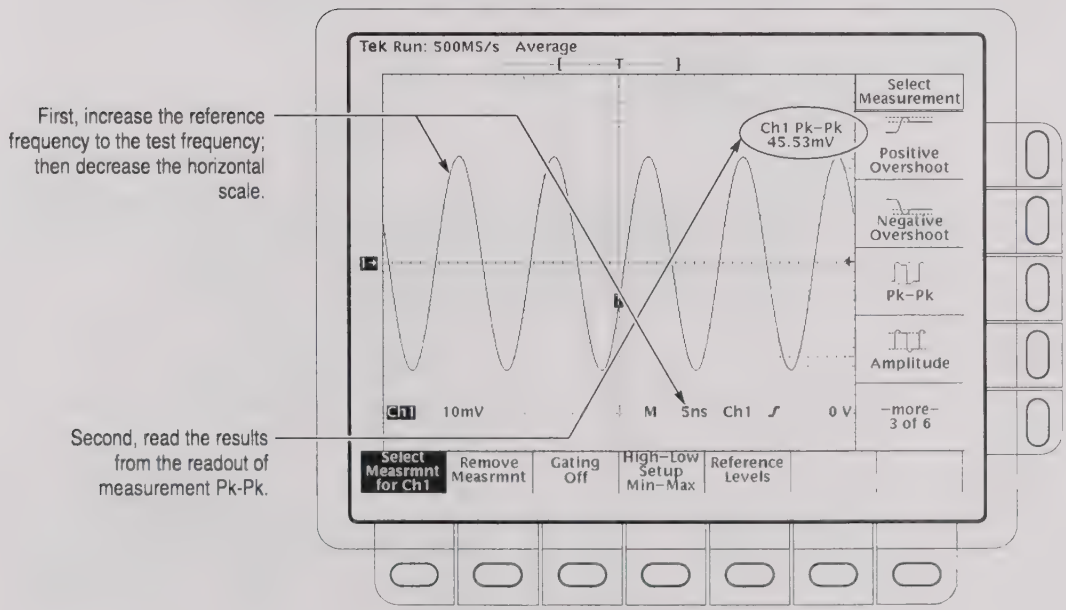


Figure 4–7: Measuring analog bandwidth

14. When finished checking, set the horizontal **SCALE** back to the 10 µs/div setting, and set the generator output frequency back to 50 kHz.
15. Press **WAVEFORM OFF** to remove Channel 1 from the display.
16. Press **CH 2** and move the hookup to the **CH 2** input.
17. Press **TRIGGER MENU → Source → CH 2**.
18. Repeat steps 6 through 13 for **CH 2**.
19. Disconnect the test hook up from the **CH 2** input connector.

Time Base System Checks

This procedure checks those characteristics that relate to the Main and Delayed time base system and are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check Long-Term Sample Rate and Delay Time Accuracy

Equipment Required: One time-marker generator (Item 9), one precision coaxial cable, (Item 2) and one 50 Ω termination (Item 1).

Time Required: Approximately 5 minutes.

Prerequisites: See page 4–11.

Procedure:

1. Connect, through a 50 Ω precision coaxial cable and a 50 Ω termination, the time-mark output of a time-marker generator to **CH 1**, as shown in Figure 4–8. Set the output of the generator for 10 ms markers.

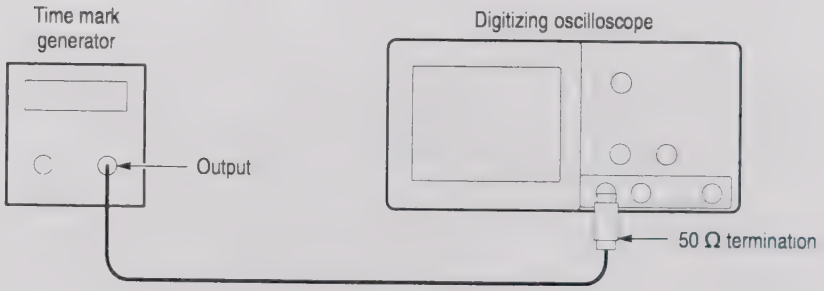


Figure 4–8: Hookup for sample rate check

2. Press **SAVE/RECALL SETUP → Recall Factory Setup → OK Confirm Factory Init**.
3. Set the vertical **SCALE** to 500 mV/div.
4. Press **SET LEVEL TO 50%**; use the vertical **POSITION** knob to center the test signal on screen.
5. Set the horizontal **SCALE** to 1 ms/div.
6. Press **HORIZONTAL MENU → Trigger Position → Set to 10%**.
7. Adjust the horizontal **POSITION** to move the trigger **T** to the right and on to the screen. Continue to position the trigger **T** to align it to the center vertical graticule line.
8. Press the main menu button **Time Base**; then press the side menu button **Delayed Only**.
9. Set the horizontal **SCALE** of the **D** (delayed) time base to 1 ms/div. Then use the **General Purpose** knob to set delay time to 10 ms.
10. Set the horizontal **SCALE** of the **D** (delayed) time base to 500 ns/div.

NOTE. *When you change the **SEC/DIV** in step 10, the delay time readout changes to 10.00001 or 9.99999. This is normal and has no effect on the verification*

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11. Check that the rising edge of the marker crosses the center horizontal graticule line at a point within ±2.0 divisions of the graticule center.

NOTE. *One division of displacement from the center graticule corresponds to a 50 ppm time base error.*

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12. Disconnect the test hookup.

Delta Time Measurement Accuracy

Delta time measurement accuracy is verified by successful completion of the previous procedure.

Trigger System Checks

These procedures check those characteristics that relate to the trigger system and are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check Edge Trigger Sensitivity, DC Coupled

Equipment Required: One leveled sine wave generator (Item 7 or 8), two precision 50 Ω coaxial cables (Item 2), one 50 Ω termination (Item 1), and one BNC T connector (Item 4).

Time Required: Approximately 10 minutes.

Prerequisites: See page 4–11.

Procedure:

1. Press **SAVE/RECALL SETUP → Recall Factory Setup → OK Confirm Factory Init**.
2. Set the vertical **SCALE** to 500 mV/div.
3. Set the horizontal **SCALE** to 10 ns/div.
4. Press **TRIGGER MENU → Mode → Normal**.
5. Press **ACQUIRE → Mode → Average 16**.
6. Connect one 50 Ω cable to the output of the sine wave generator. Attach a BNC T connector to the other end of the cable. Connect a second 50 Ω cable to the other side of the BNC T connector.
7. Connect the BNC T connector to **CH 1**; connect the cable to the **EXT TRIG** input through a 50 Ω termination as shown in Figure 4–9.

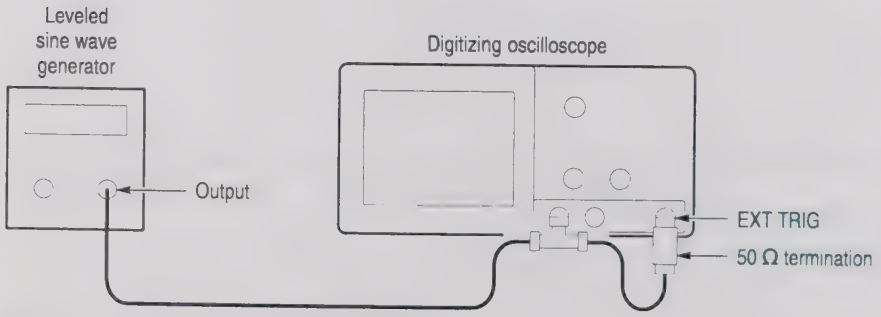

Figure 4–9: Hookup for trigger sensitivity check

8. Set the generator frequency to 100 MHz (TDS 340A), 200 MHz (TDS 360), or 400 MHz (TDS 380).
9. Press **MEASURE → High-Low Setup → Min-Max**.
10. Press the main menu button **Select Measurement**.
11. Press the side menu button **-more-** until **Amplitude** appears in the side menu. Press the side menu button **Amplitude**.
12. Press **SET LEVEL TO 50%**.
13. Set the test signal amplitude for about one division on screen. Fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 500 mV. (Readout may fluctuate around 500 mV.)
14. Press **TRIGGER MENU → Slope**.
15. Press **SET LEVEL TO 50%**. Check that a stable trigger is obtained for the test waveform on both the positive and negative slopes (see Figure 4–10). (Use the side menu to switch between trigger slopes; use the trigger **LEVEL** knob to stabilize the trigger if required.)

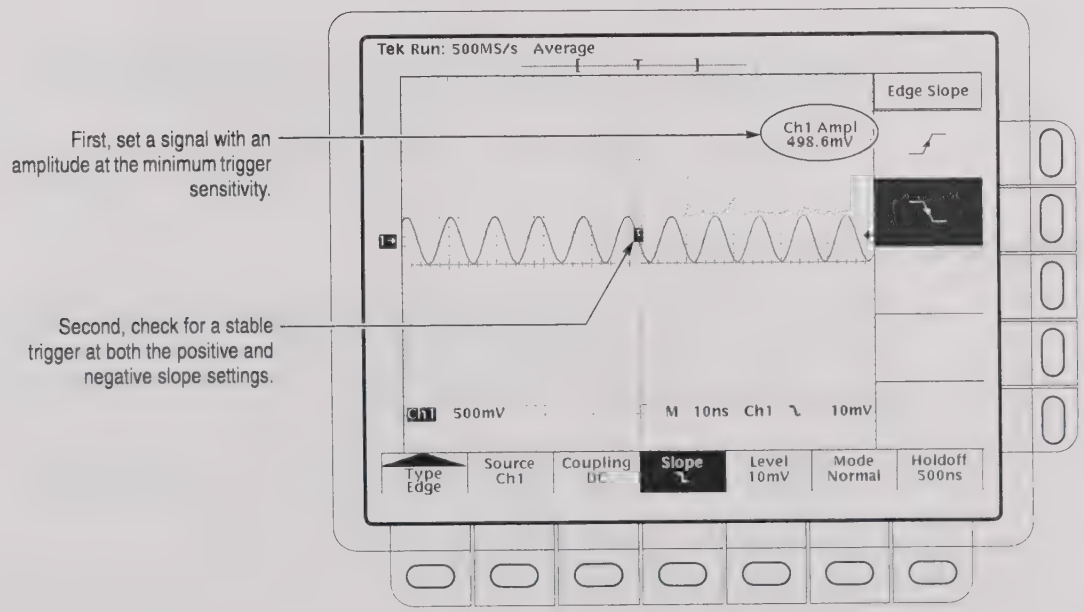

Figure 4–10: Measuring trigger sensitivity

16. Press **WAVEFORM OFF**.
17. Press **CH 2**.
18. Press **TRIGGER MENU → Source → Ch2**.
19. Disconnect the hookup from **CH 1** and connect it to **CH 2**.
20. Set the vertical **SCALE** to 500 mV/div.
21. Repeat steps 14 and 15 for Channel 2.
22. Press **TRIGGER MENU → Source → EXT/10**.
23. Press **MEASURE → Select Measrmnt → Amplitude**.
24. Increase the generator amplitude until the amplitude measurement reads 1.5 V if you are checking a TDS 340A or TDS 360. Increase the generator amplitude until the amplitude measurement reads 4.0 V if you are checking a TDS 380.
25. Repeat steps 14 and 15 for the external trigger.
26. Disconnect the test hookup.

Trigger Level Accuracy, DC Coupled

Trigger level accuracy is verified by the successful completion of the Self Tests and the DC voltage measurement accuracy procedure on page 4–11.

This completes the performance verification procedure.

Sine Wave Generator Leveling Procedure

Some procedures in this manual require a sine wave generator to produce the necessary test signals. If you do not have a leveled sine wave generator, use the following procedure to level the output amplitude of your sine wave generator using a power meter.

Equipment Required: Sine wave generator, level meter and power sensor, power splitter, and one precision coaxial cable.

Time Required: About 5 minutes.

Prerequisites: See page 4–11.

Procedure:

1. Connect the equipment as shown in Figure 4–11.
2. Set the sine wave generator to a reference frequency of 50 kHz.

3. Adjust the sine wave generator amplitude to the required number of divisions as measured by the oscilloscope.
4. Note the reading on the level meter.
5. Change the sine wave generator to the desired new frequency.
6. Input the correction factor for the new frequency into the level meter.
7. Adjust the sine wave generator amplitude until the level meter again reads the value noted in step 4. The signal amplitude is now correctly set for the new frequency.

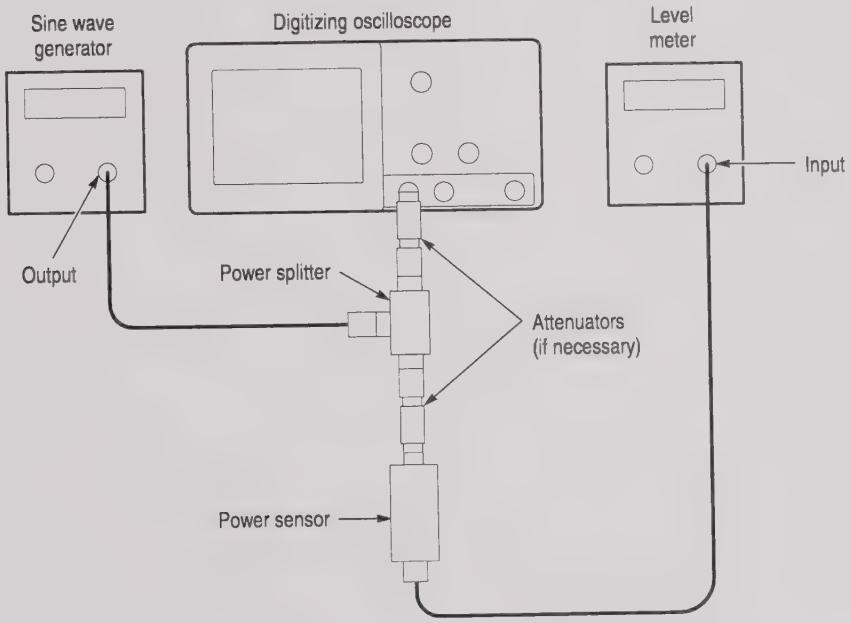

Figure 4–11: Hookup for sine wave generator leveling

Adjustment Procedures

This section contains information you need to adjust the TDS 340A, TDS 360, and TDS 380. There are only three types of adjustments you can perform on the oscilloscope: the automated and semiautomated adjustments in the system calibration menu, attenuator adjustments, and monitor adjustments.

You should perform the signal path compensation adjustment after servicing your instrument or moving your instrument to a new operating environment (±5° C temperature change). The other adjustment procedures may be necessary if the instrument fails one of the *Performance Tests* in the previous section.

You should allow the instrument a 20 minute warm-up period before performing any adjustments.

Adjustment Interval. These adjustments should be done once a year.

Equipment Required

Table 5–1 lists the equipment you will need to do the adjustment procedures.

Table 5–1: Adjustment equipment

Item number and description	Minimum requirements	Example	Purpose
1. Adjustment Tool	0.075 inch slot screwdriver	Tektronix part number 003-1433-01 (standard probe adjustment tool)	Monitor and attenuator adjustments
2. Termination, 50 Ω	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0049-01	Timing calibration and attenuator adjustment
3. Cable, Precision Coaxial	50 Ω, 36 in, male to male BNC connectors	Tektronix part number 012-0482-00	Attenuator adjustments and system calibration
4. Generator, DC Calibration	Variable amplitude to ±10 V; accuracy to 0.05%	Wavetek 9100 Calibration System with Option 250	Voltage and external trigger calibrations
5. Generator, Fast-rise Step	$t_r \leq 10$ ns; amplitude ≤ 1 V_{p-p}	Wavetek 9100 Calibration System with Option 250	Timing calibration and attenuator adjustment

The System Calibration Menu

The oscilloscope has four onboard calibration routines. You can access these routines through the system calibration menu. Use the following procedure.

NOTE. *The Voltage, Timing, and External Trigger calibration routines are disabled at the factory. To enable the calibration menus, refer to* Enabling Calibration Menus *on page 6–31.*

Equipment Required: One DC calibration generator (Item 4), one precision coaxial cable (Item 3), one fast–rise step generator (Item 5), and one 50 Ω termination (Item 2).

1. Press **UTILITY**.
2. Press the leftmost main menu button until the pop-up menu shows the **Cal** selection. This calls up the system calibration menu, shown in Figure 5–1.

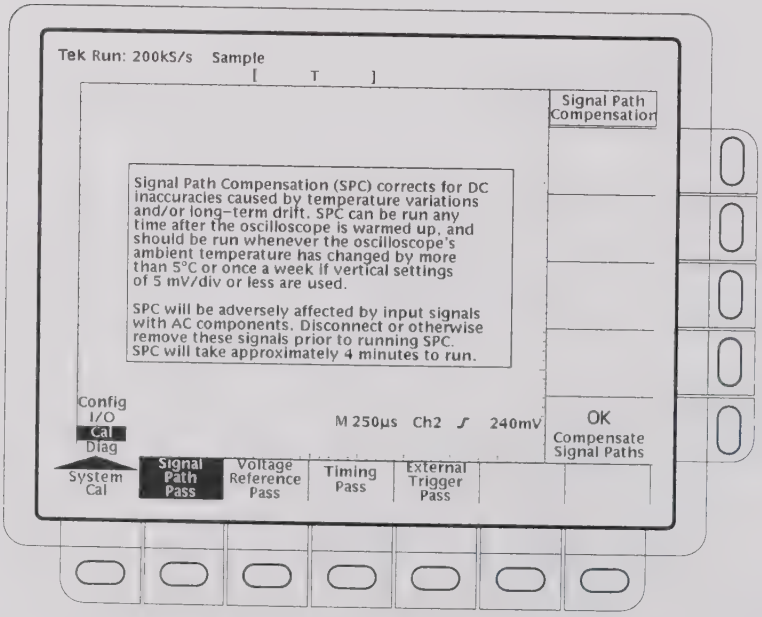
Tek Run: 200kS/s Sample
[T]
Signal Path Compensation
Signal Path Compensation (SPC) corrects for DC inaccuracies caused by temperature variations and/or long-term drift. SPC can be run any time after the oscilloscope is warmed up, and should be run whenever the oscilloscope's ambient temperature has changed by more than 5°C or once a week if vertical settings of 5 mV/div or less are used.
SPC will be adversely affected by input signals with AC components. Disconnect or otherwise remove these signals prior to running SPC. SPC will take approximately 4 minutes to run.
Config
I/O
Cal
Diag
M 250µs Ch2 ƒ 240mV
OK
Compensate
Signal Paths
System
Cal
Signal
Path
Pass
Voltage
Reference
Pass
Timing
Pass
External
Trigger
Pass

Figure 5–1: The system calibration menu

3. Remove all input signals from the front panel BNC connectors.
4. Press the main menu button **Voltage Reference**. Read the on-screen text before continuing.

5. Press the side menu button **OK Calibrate Voltage Ref**. Connect a DC calibration generator (Item 4) to the **CH 1** input through a 50 Ω coaxial cable (Item 3) and follow the instructions on the screen.

6. Press **UTILITY**.

7. Press the main menu button **Signal Path**. Read the on-screen text before continuing.

8. Press the side menu button **OK Compensate Signal Paths**.

9. Wait. The signal path compensation routine takes about four minutes to run.

10. Move the DC calibration generator (Item 4) from the **CH 1** input to the **EXT TRIG** input.

11. Press **UTILITY**.

12. Press the main menu button **Ext Trig**. Read the on-screen text before continuing.

13. Press the side menu button **OK Calibrate External Trig**. Follow the instructions on the screen.

14. Disconnect the DC calibration generator and connect the –1 V fast rise output of a calibration generator to the **CH 1** input through a 50 Ω coaxial cable and a 50 Ω termination (Item 2).

15. Set the calibration generator to output a 1 ms, fast rise signal; set the pulse amplitude to 50%.

16. Press **SAVE/RECALL SETUP**. Press the main menu button **Recall Factory Setup**; then press the side menu button **OK Confirm Factory Init**.

17. Press **AUTOSET**. Then adjust the vertical **POSITION** control to center the waveform on the screen so that the trigger arrow is at the center graticule, set the **VOLTS/DIV** to 50 mV, and set the **SEC/DIV** to 250 ns. This should result in a waveform similar to the one shown in Figure 5–2.

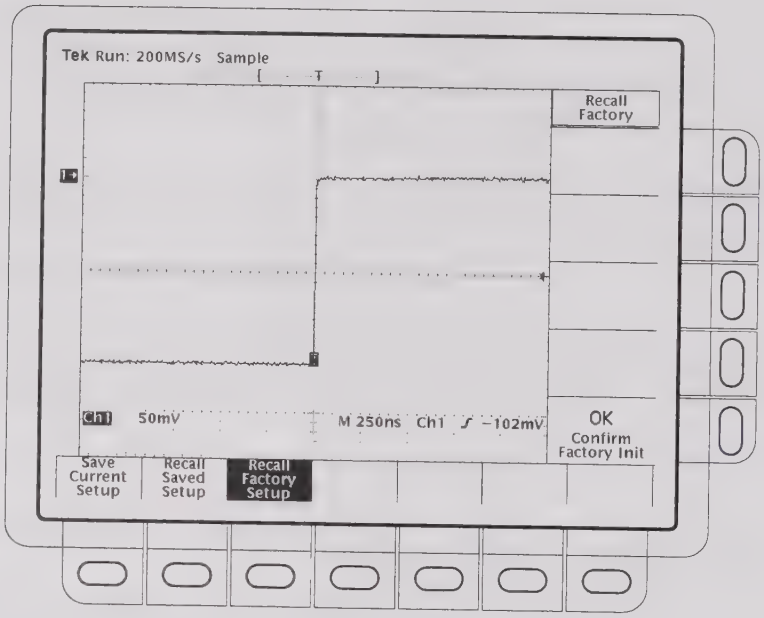

Figure 5–2: Timing compensation waveform

18. Press **UTILITY**.
19. Press the main menu button **Timing**. Read the on-screen text before continuing.
20. Press the side menu button **OK Compensate Timing**. Follow the instructions on the screen.

Attenuator Adjustment

Use this procedure to adjust the low-frequency compensation of the channel 1 and channel 2 attenuators. You should perform this procedure if your oscilloscope demonstrates gross rounding or overshoot of square-wave input signals or if your instrument fails one of the *Performance Tests* in the previous section.

Equipment Required: One adjustment tool (Item 1), one precision coaxial cable (Item 3), one fast–rise step generator (Item 5), and one 50 Ω termination (Item 2).

1. Remove the instrument cabinet as described in the removal procedure on page 6–11.
2. Set the oscilloscope on its left side with its front facing toward you.
3. Power up the oscilloscope and press **SAVE/RECALL SETUP**.

4. Press the main menu button **Recall Factory Setup**; then press the side menu button **OK Confirm Factory Init**.
5. Press **CLEAR MENU**.
6. Connect the high output of a fast–rise step generator (Item 5) to the **CH 1** BNC through a 50 Ω coaxial cable (Item 3) and a 50 Ω termination (Item 2). (See Figure 5–3.)
7. Set the calibration generator to output a high amplitude, 1 kHz signal. Set the pulse amplitude to 25%.
8. Set the oscilloscope **VOLTS/DIV** to 200 mV, the **SEC/DIV** to 10 µs, and adjust the pulse amplitude for a five division display.
9. Press **SET LEVEL TO 50%**.
10. Use the vertical **POSITION** control to place the top of the waveform near center screen.
11. Set the **VOLTS/DIV** to 100 mV.
12. Use an adjustment tool (Item 1) to adjust the CH 1 10X capacitor for the flattest response. (See Figure 5–3.)
13. Remove the 50 Ω termination from the setup.
14. Set the **VOLTS/DIV** to 2 V.

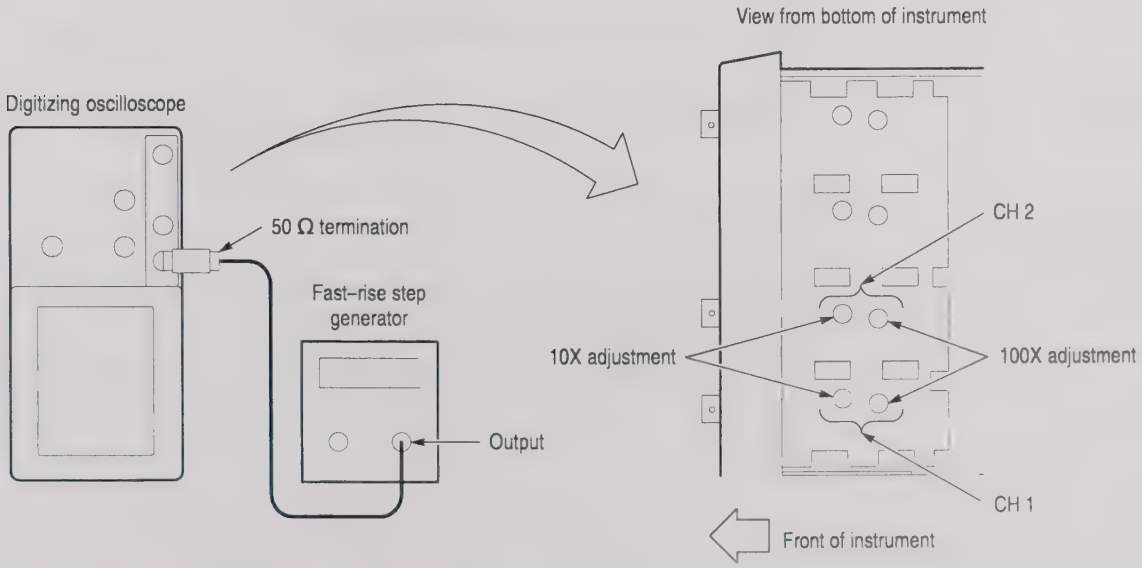

Figure 5–3: Attenuator adjustment setup and locations

15. Press **SET LEVEL TO 50%**.
16. Adjust the pulse amplitude for a five-division display.
17. Set the **VOLTS/DIV** to 1 V.
18. Use an adjustment tool to adjust the CH 1 100X capacitor for the flattest response.
19. Press **WAVEFORM OFF**, **CH 2**, and **TRIGGER MENU**, *in that order.*
20. Press the main menu button **SOURCE**; then press the side menu button **Ch2**.
21. Move the coaxial cable to the **CH 2** BNC input, reinstalling the 50 Ω termination.
22. Repeat steps 7 through 18 for channel 2.
23. Reinstall the instrument cabinet.

Monitor Adjustments

There are no set performance requirements for the monitor. You may use this procedure to change monitor parameters whenever the brightness, contrast, horizontal position, or vertical position of the display is not to your liking.

Equipment Required: One adjustment tool (Item 1).

1. Remove the instrument cabinet as described in the removal procedure on page 6–11.
2. Set the oscilloscope bottom-down with its front facing toward you.
3. Turn on the oscilloscope and allow a 20 minute warm-up period.
4. Press **DISPLAY**.
5. Press the main menu button **Intensity**. Use the side menu to set overall intensity to 100%, **Text/Grat** to bright, and **Waveform** to bright.
6. Locate the brightness potentiometer (see Figure 5–4). Use an adjustment tool (Item 1) to raise the brightness until the background of the screen turns green.

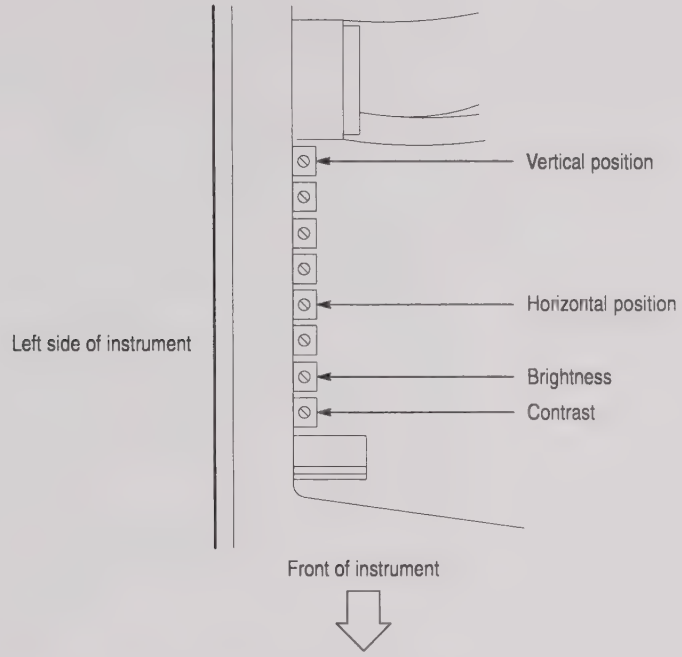

Figure 5–4: Monitor adjustments

7. Now lower the brightness *just beyond the point* where the background fades to black.
8. Locate the contrast potentiometer. Adjust the contrast to your taste.

CAUTION. *The higher the contrast, the higher the likelihood that prolonged use will cause CRT burn-in.*

9. Locate the vertical position potentiometer. Adjust the vertical position until the display is vertically centered on the screen.
10. Locate the horizontal position potentiometer. Adjust the horizontal position until the display is horizontally centered on the screen.

Maintenance

This chapter describes how to inspect, clean, remove, and troubleshoot the oscilloscope at the module level.

Preventive maintenance, when done regularly, may prevent oscilloscope malfunction and enhance its reliability. Preventive maintenance consists of visually inspecting and cleaning the oscilloscope and using general care when operating it. How often to do maintenance depends on the severity of the environment in which you use the oscilloscope. A proper time to perform preventive maintenance is just before oscilloscope adjustment.

Preventing ESD

CAUTION. *Static discharge can damage any semiconductor component in this oscilloscope.*

Precautions

When performing any service which requires internal access to the oscilloscope, adhere to the following precautions to avoid damaging internal modules and their components due to electrostatic discharge (ESD).

1. Minimize handling of static-sensitive modules.
2. Transport and store static-sensitive modules in their static protected containers. Label any package that contains static-sensitive modules.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules. Do service of static-sensitive modules only at a static-free work station.
4. Do not remove the oscilloscope cabinet unless you have met precaution number 3, above. Consider all internal modules static-sensitive.
5. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
6. Handle circuit boards by the edges when possible.
7. Do not slide the modules over any surface.
8. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.
9. Do not use high-velocity compressed air when cleaning dust from modules.

General Care

The cabinet helps keep dust out of the oscilloscope and it is a major component of its cooling system. It should normally be in place when operating the oscilloscope. The optional oscilloscope front cover protects the front panel and display from dust and damage. Install it when storing or transporting the oscilloscope.

Inspection and Cleaning Procedures

Inspect and clean the oscilloscope as often as operating conditions require. The collection of dirt on components inside can cause them to overheat and breakdown. (Dirt acts as an insulating blanket, preventing efficient heat dissipation.) Dirt also provides an electrical conduction path that could cause an oscilloscope failure, especially under high-humidity conditions.

CAUTION. *Avoid the use of chemical cleaning agents that might damage the plastics used in this oscilloscope. Use only deionized water when cleaning the menu buttons or front-panel buttons. Use a 75% isopropyl alcohol solution as a cleaner and rinse with deionized water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.*

Avoid the use of high pressure compressed air when cleaning dust from the interior of this instrument. (High pressure air can cause ESD.) Instead, use low pressure compressed air (about 9 psi).

Inspection — Exterior

Using Table 6–1 as a guide, inspect the outside of the oscilloscope for damage, wear, and missing parts. You should thoroughly check oscilloscopes that appear to have been dropped or otherwise abused to verify correct operation and performance. Immediately repair defects that could cause personal injury or lead to further damage to the oscilloscope.

Table 6–1: External inspection check list

Item	Inspect for	Repair action
Cabinet, front panel, and cover	Cracks, scratches, deformations, damaged hardware or gaskets	Replace defective module
Front-panel knobs	Missing, damaged, or loose knobs	Repair or replace missing or defective knobs
Connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors	Replace defective modules. Clear or wash out dirt
Carrying handle and cabinet feet	Correct operation	Replace defective module
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors	Replace damaged or missing items, frayed cables, and defective modules

Cleaning Procedure — Exterior

WARNING. *To avoid injury or death, unplug the power cord from line voltage before cleaning the oscilloscope. To avoid getting moisture inside the oscilloscope during external cleaning, use only enough liquid to dampen the cloth or applicator.*

1. Remove loose dust on the outside of the oscilloscope with a lint free cloth.
2. Remove remaining dirt with a lint free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.
3. Clean the monitor screen with a lint-free cloth dampened with either isopropyl alcohol or, preferably, a gentle, general purpose detergent-and-water solution.

Inspection — Interior

To access the inside of the oscilloscope for inspection and cleaning, refer to the *Removal and Replacement* procedures in this section.

Inspect the internal portions of the oscilloscope for damage and wear, using Table 6–2 as a guide. You should repair defects immediately.

If you replace any electrical module, perform the adjustment procedures, beginning on page 5–1.

CAUTION. *To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the oscilloscope.*

Table 6–2: Internal inspection check list

Item	Inspect for	Repair action
Circuit boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating	Remove the failed module and replace it with a new module
Resistors	Burned, cracked, broken, or blistered condition	Remove the module with the faulty resistor and replace it with a new module
Solder connections	Cold solder or rosin joints	Resolder joint and clean with isopropyl alcohol
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals	Remove the module with the faulty capacitor and replace it with a new module from the factory
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring	Firmly seat connectors. Repair or replace modules with defective wires or cables
Chassis	Dents and deformations	Straighten, repair, or replace chassis

Cleaning Procedure — Interior

STOP. *If, after doing steps 1 and 2, a module is clean upon inspection, skip the remaining steps.*

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint free cloth dampened in isopropyl alcohol (75% solution) and rinse with warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)

NOTE. *If steps 1 and 2 do not remove all the dust or dirt, the oscilloscope may be spray washed using a solution of 75% isopropyl alcohol by doing steps 3 through 7.*

3. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal and Replacement* procedures).
4. Spray wash dirty parts with the isopropyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
5. Use hot (120° F to 140° F or 48.9° C to 60° C) deionized water to thoroughly rinse them.
6. Dry all parts with low-pressure, deionized air.
7. Dry all components and assemblies in an oven or drying compartment using low-temperature (125° F to 150° F or 51.7° C to 65.5° C) circulating air.

Removal and Replacement

This section contains procedures for removal and installation of all mechanical and electrical modules.

Preparation — Please Read

WARNING. *To avoid injury or death, disconnect the power cord from the line voltage source before performing any procedure in this section.*

General Instructions

STOP. READ THESE GENERAL INSTRUCTIONS BEFORE REMOVING A MODULE.

First locate the module you want to remove in the exploded views (Figures 10–1 and 10–2 on pages 10–6 and 10–8). Then read Equipment Required *for a list of the tools needed to remove and install modules in this oscilloscope.*

To remove an internal module, you need only remove the oscilloscope cabinet (page 6–11) and then perform the removal procedure for that module. The internal modules are independently removable.

Procedures will refer to "front," "rear," "top," etc. of the oscilloscope; note from Figure 6–1 which sides are referenced.

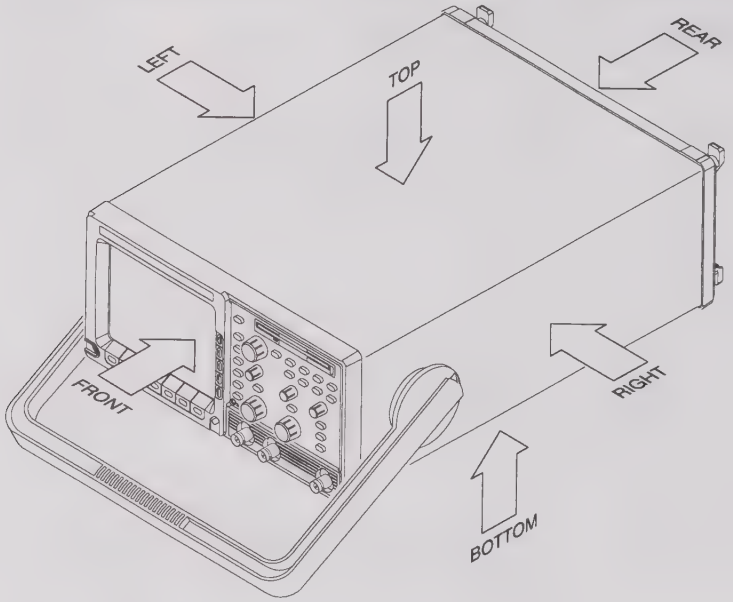

Figure 6–1: Oscilloscope orientation

Equipment Required

The tools listed in Table 6–3 are required to completely disassemble the oscilloscope into its modules. The tools required to remove an individual module are listed before the first step of its procedure.

All the tools are standard tools readily available from tool suppliers.

Table 6–3: Tools required for module removal

Item no.	Name	Description
1	Screwdriver handle	Accepts Torx®-driver bits
2	T-15 Torx tip	Torx®-driver bit for T-15 size screw heads
3	T-20 Torx tip	Torx®-driver bit for T-20 size screw heads. Used only for removal of the cabinet handle
4	Flat-bladed screwdriver	Screwdriver for removing standard-head screws
5	Pozidriv screwdriver	Screwdriver for removing Pozidriv® screws
6	Nut driver, 5/16 inch	Used for removing earth ground cables
7	Nut driver, 3/16 inch	Used for removing GPIB connector shell and EMI gasket
8	Angle-tip tweezers	Used for knob and shaft removal
9	Slip-Jaw Pliers	Used for removing the front feet from the cabinet

Table 6–3: Tools required for module removal (Cont.)

Item no.	Name	Description
10	Wooden Spudger	Used for front EMI gasket removal
11	Front Cover	This optional accessory protects the front of the oscilloscope when positioned face down in the removal procedures
12	Gloves, lint free, cloth	Used for removing the menu elastomer and menu button flex circuit
13	Soldering Iron	15 watt. Used for removal of some cables
14	Solder Wick	
15	BNC Wrench	Removing BNCs from the attenuator assembly. Tektronix 003-1463-00
16	BNC Fixture	Installing BNCs on the attenuator assembly. Tektronix 003-1464-00

Line Fuse and Line Cord

WARNING. *To avoid injury or death, unplug the line cord from the line voltage power source before continuing.*

Required tool: a flat-bladed screwdriver (Item 4).

1. Set the oscilloscope so its bottom is down on the work surface and its rear is facing you.
2. Find the line cord on the rear cover. (See Figure 6–2.) Now, remove the line-cord retaining clamp by first unplugging the line cord from its receptacle.
3. Next, grasp both the line cord and the retaining clamp and rotate them 90 degrees counter-clockwise.

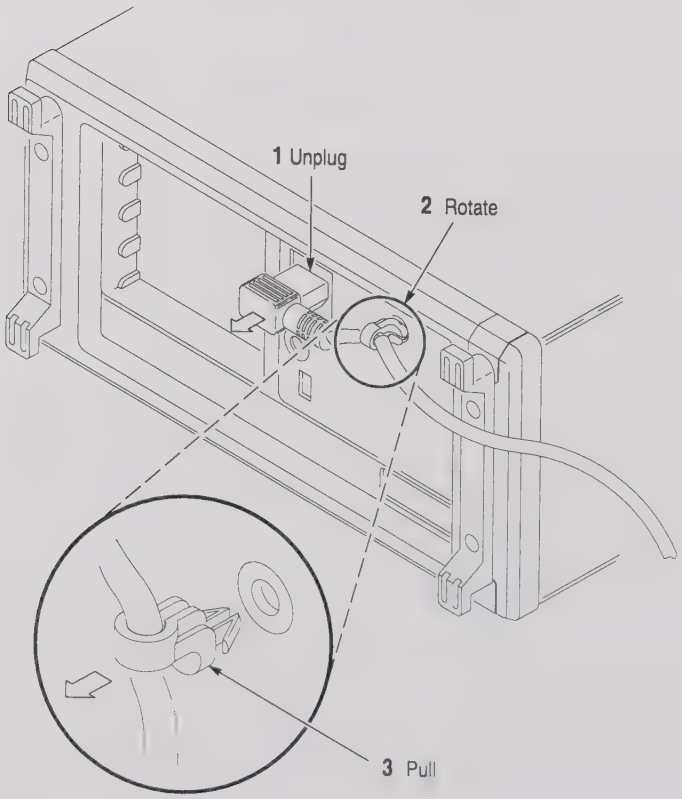

Figure 6–2: Line cord removal

4. Pull the line cord and clamp away to complete the removal.
5. Locate the fuse drawer beneath the line voltage plug on the rear panel. Pry open the drawer with a small flat-bladed screwdriver (Item 4), and remove the line fuse. (See Figure 6–3.)
6. *Reinstallation:* Do in reverse steps 5 through 2 to reinstall the line fuse and then the line cord.

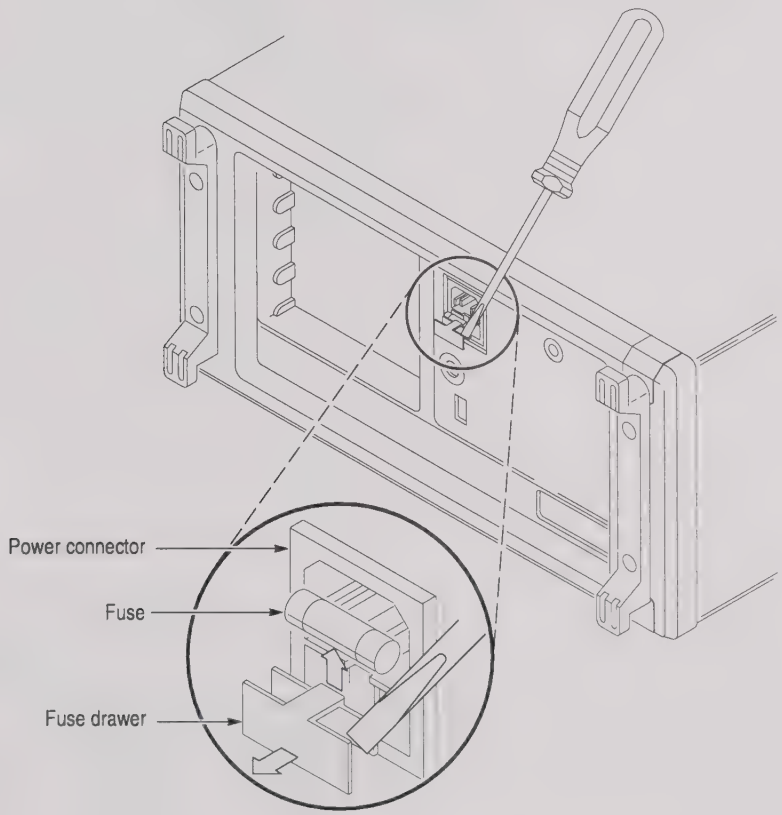

Figure 6–3: Line fuse removal

Front Panel Knobs and Shafts

Required tool: a pair of angle-tip tweezers (Item 8).

1. Set the oscilloscope so its bottom is down on the work surface and its front is facing you.
2. Refer to Figure 6–4. Grasp the knob you want to remove and pull it straight out from the front panel slightly to create some clearance between the base of the knob and the front panel.
3. Insert the tweezers between the knob and front panel and use them to remove the knob and its shaft. Pull the shaft out of the knob to remove.
4. *Reinstallation:*
   a. To reinstall, align the inside of the knob to the end of the shaft and push it in until it snaps.
   b. Insert the shaft of the assembled knob into its hole in the front panel assembly until it stops.
   c. Rotate the knob while lightly pushing inwards until the shaft slips into its receptacle. Push all the way in to seat the knob assembly.

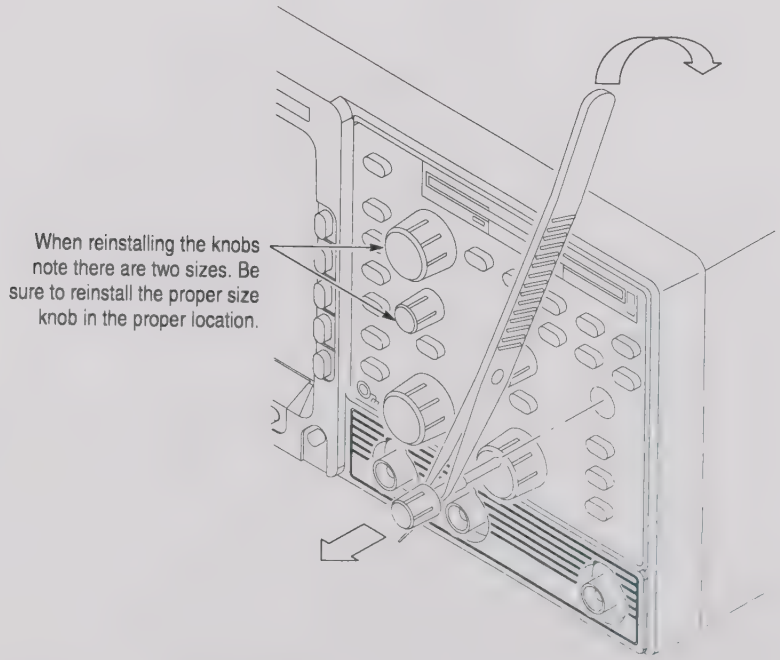

Figure 6–4: Knob and shaft removal

Rear Cover, Cabinet, and Cabinet Handle

Required tool: a screwdriver with a size T-15 Torx® tip (Items 1 and 2).

1. Pull out on both of the hubs on the cabinet handle to unlock it for positioning. While holding the hubs unlocked, rotate the handle towards the bottom of the oscilloscope.
2. Set the oscilloscope so its face is down with its front cover on the work surface and its bottom facing you. Reference Figure 6–5 on page 6–12 as you do the following steps.
3. Remove the four T-15 Torx® screws securing the rear cover to the oscilloscope. Lift off the rear cover. If no other parts are being serviced, skip to the end (step 10) of this procedure.
4. Remove the single T-15 Torx® screw at the left side of the oscilloscope.
5. Lift the cabinet upwards to slide it off the oscilloscope.
6. If no other cabinet parts are being serviced, skip the rest of this procedure.
7. Working from the inside of the cabinet, remove the T-20 Torx® screw securing each handle hub to the cabinet.
8. Working from the outside of the cabinet, grasp the two handle hubs and pull them outward from the cabinet until they are out of the cabinet.
9. While holding the handle hubs pulled out, lift the handle away to remove.
10. *Reinstallation:*
    a. Do, in reverse order, steps 8 and 7 to reinstall the handle assembly.
    b. Do, in reverse order, steps 5 through 3 to reinstall the cabinet, while observing the following precautions:
        - Take care not to bind or snag the cabinet on internal cabling; redress cables as necessary.
        - When sliding the cabinet onto the oscilloscope, be sure that the front and rear ridges of the main chassis slide into the grooves at the rear of the cabinet and on the front trim.
        - Install the four screws at the rear panel before installing the single screw at the left side of the cabinet.

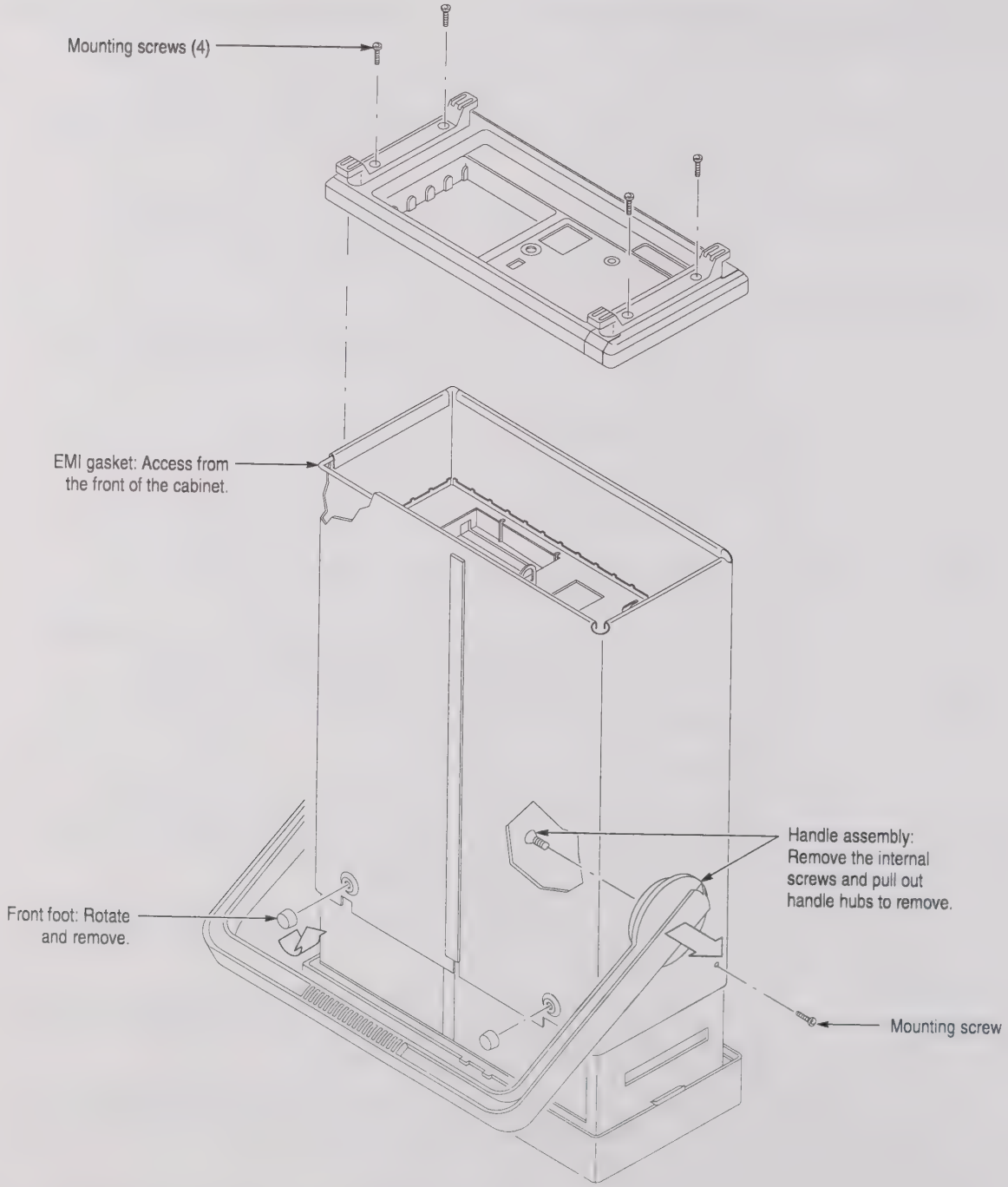
Mounting screws (4)
EMI gasket: Access from the front of the cabinet.
Handle assembly: Remove the internal screws and pull out handle hubs to remove.
Front foot: Rotate and remove.
Mounting screw

Figure 6–5: Rear cover, cabinet, and cabinet handle and feet removal

Disk Drive

Required tools: a screwdriver with a size T-15 Torx tip (items 1 and 2) and a Pozidriv screwdriver (item 5).

1. Set the oscilloscope so its bottom is down, and its front is facing you.
2. To remove the disk drive, perform the following steps using Figure 6–6 as a guide:
   a. Lift up on the two locking tabs on J1 of the disk drive.
   b. Remove cable J1 from the drive.
   c. If present, remove the T-15 Torx-drive screw that clamps the drive in the chassis. When replacing the drive, do not reinstall this screw.
   d. Remove the one or two screws securing the drive to the chassis. When replacing a drive without a spacer, use one 4.0 mm screw.
   e. Push the drive from the back until it extends one to two inches beyond the front panel. Then grasp the drive by its front edges and pull it out of the front panel to complete its removal.
   f. If present, remove the screw securing the spacer to the drive, and lift the spacer away from the drive to complete the removal.
3. To reinstall the disk drive, perform steps 2a-2f in reverse order.

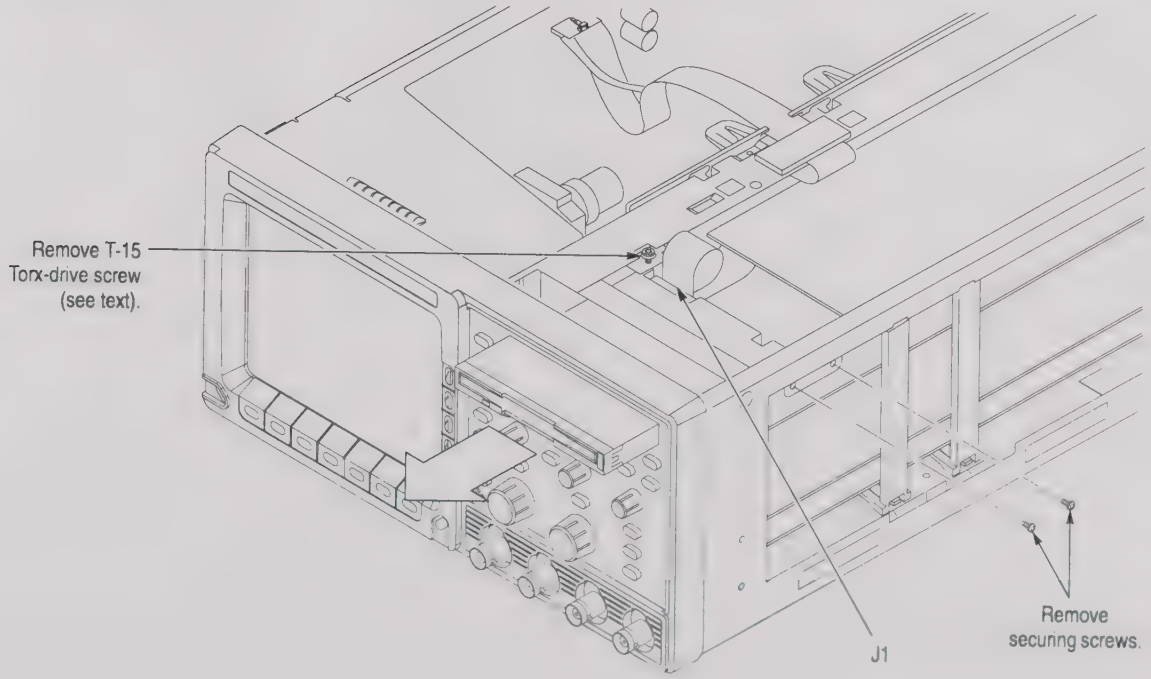

Figure 6–6: Removing the disk drive

Trim Ring, Menu Elastomer, Menu Buttons, and Front EMI Gaskets

Required tool: a wooden spudger (Item 10).

1. Set the oscilloscope so its rear is down on the work surface and its bottom is facing you.

STOP. *DO NOT touch the carbon contact points on the menu elastomer installed in the trim ring. Also, do not touch the contacts on the menu button flex circuit exposed when you remove the trim ring. You should wear clean cloth gloves that are free of lint when handling the menu elastomer or when touching the menu button flex circuit mounted on the front chassis.*

2. Grasp the trim ring by its top edge, pry it up, and lift it forward to snap it off the top front of the main chassis (see Figure 6–7).

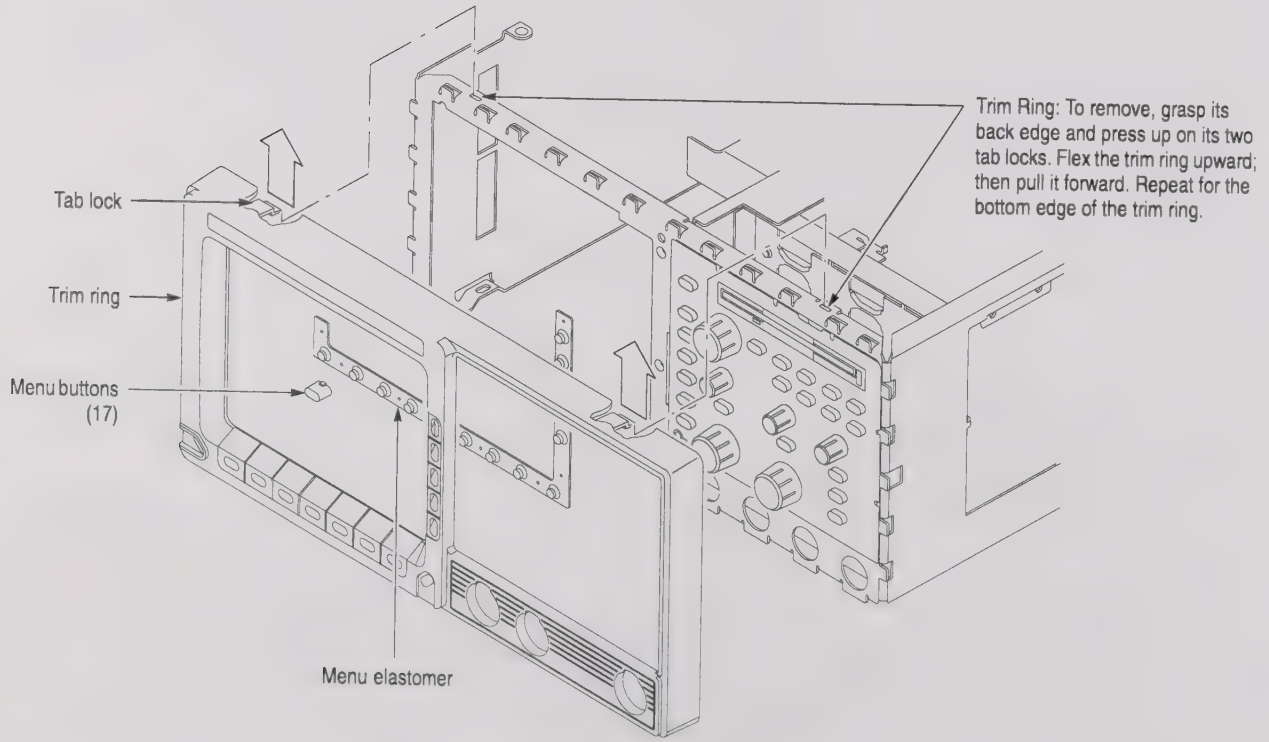
Trim Ring: To remove, grasp its back edge and press up on its two tab locks. Flex the trim ring upward; then pull it forward. Repeat for the bottom edge of the trim ring.
Tab lock
Trim ring
Menu buttons (17)
Menu elastomer

Figure 6–7: Trim ring, menu elastomer, and menu buttons removal

3. Repeat the process, prying on the bottom edge of the trim ring to complete its removal. Lay the trim ring on its face on the work surface.
4. If you are servicing the front EMI gaskets, discard the old ones.
5. If you are servicing the menu elastomer, lift it out of the trim ring.
6. If you are servicing the menu buttons, lift them out of the trim ring.
7. *Reinstallation:*
   a. Insert each button into its hole in the trim ring.
   b. Align the menu elastomer over the menu button holes in the trim ring and press it in to install. Avoid touching the carbon contact points on the elastomer when installing.
   c. Without installing the EMI gaskets, align the trim ring to the front of the chassis and push it on to seat. Be sure that both pairs of flex locks, one pair each at the inside top and bottom of the trim ring, snap over the edge of the chassis.
   d. Lay the oscilloscope so its front cover is on the work surface.
   e. Align an EMI gasket so it lies between any pair of adjacent flex locks along the groove between the cabinet.
   f. Using a wood spudger, push the EMI gasket until it is firmly seated at the bottom of the groove (see Figure 6–8). It should not overlap either flex lock.
   g. Repeat the process just described to install the remaining three gaskets.

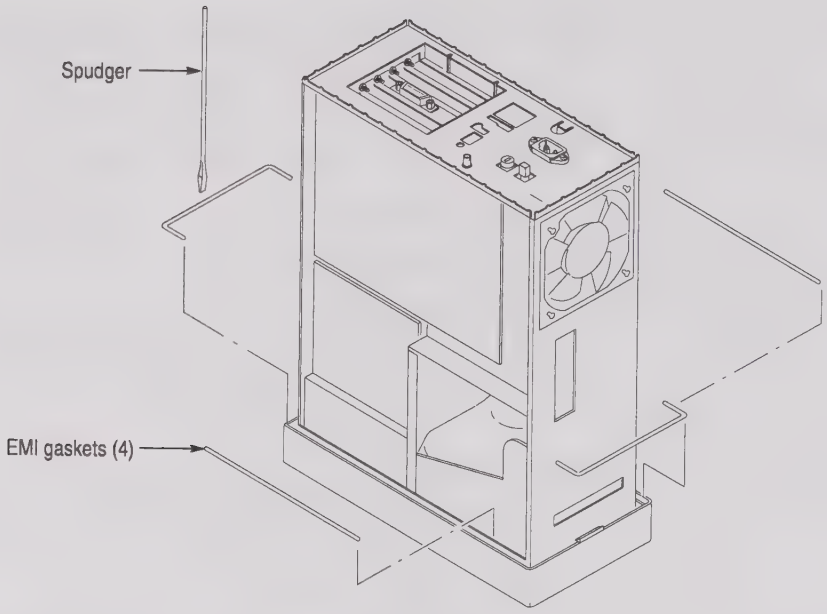

Figure 6–8: EMI gasket removal and installation

Front Panel Assembly and Menu Flex Circuit

Required tool: a flat-bladed screwdriver (Item 4).

1. Perform the previous procedure to remove the trim ring.
2. Set the oscilloscope so its bottom is down on the work surface and its front is facing you.
3. Insert a flat-bladed screwdriver into the slot at the front-right of the chassis (see Figure 6–9). Push inwards to release the snap lock at the right side.
4. Lift the front panel assembly out of the front of the main chassis until you can reach the interconnect cables connecting it to various other modules.
5. Unplug the main board and menu flex-circuit cables from their jacks on the front panel assembly.
6. Finally, lift the front panel assembly out of the front of the main chassis to complete the removal.

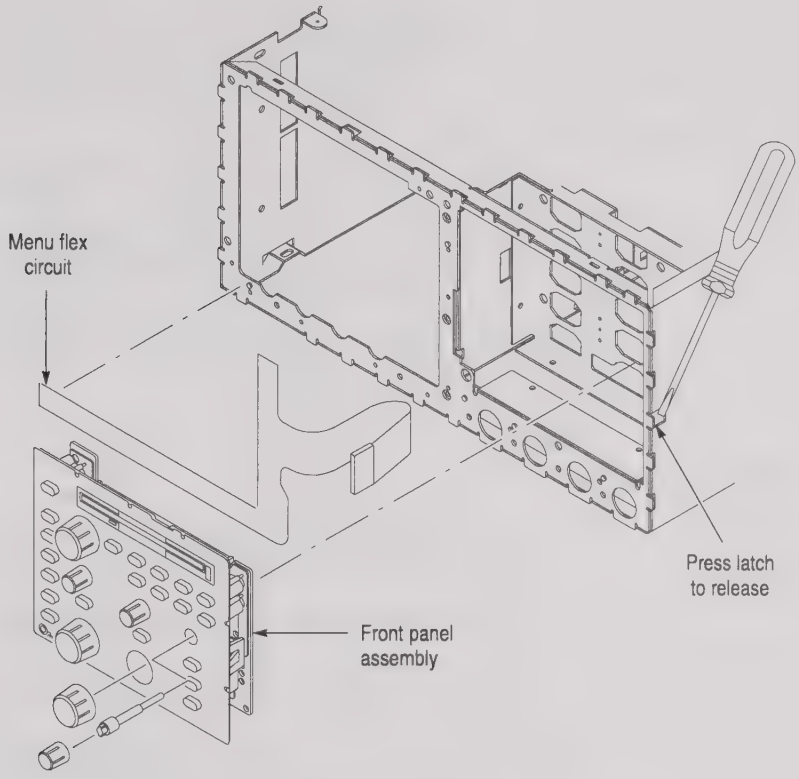

Figure 6–9: Front panel assembly and menu flex circuit removal

7. If you are removing the menu flex circuit, pull the circuit away from the front of the main chassis.
8. *Reinstallation:*
   a. If you are replacing the menu flex circuit, perform the following subparts:
      - Wipe the front of the chassis using isopropyl alcohol and a clean, lint-free cloth. Let it dry.
      - Find the score line in the adhesive backing and peel the backing off the menu flex circuit.

- Carefully align the three holes on the menu flex circuit to the locator studs on the front of the main chassis. When the alignment is correct, press the flex circuit against the chassis so it adheres to the chassis.
- Clean the surface of the menu flex circuit using isopropyl alcohol and a clean, lint-free cloth.

b. Reconnect the main board and menu flex-circuit cables to the back of the front panel assembly.

c. Carefully reinsert the front-panel assembly into the main chassis *left side first*.

Main Board Assembly

Required tools: a screwdriver with a size T-15 Torx® tip (Items 1 and 2), BNC wrench (Item 15), BNC fixture (Item 16), and soldering iron (Item 13).

1. Remove the front trim ring as described on page 6–14.
2. Set the oscilloscope so its top side is down on the work surface and its rear is facing you.
3. Remove the floppy interface board, shown in Figure 6–10, by removing the screw, unclipping the standoff post from the board, and gently rocking the board from side to side while lifting. Make sure that you lift and rock from the connector end of the board.

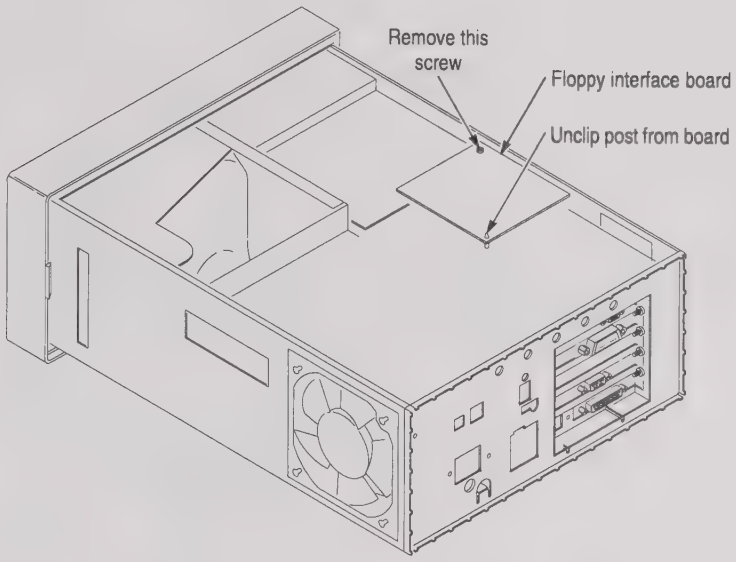

Figure 6–10: Removing the floppy interface board

4. Unplug the power supply cable *at the power supply.*
5. Unplug the monitor cable *at the monitor assembly and power supply*; carefully route the cable out through its access hole.
6. Unplug the front panel cable.
7. Using Figure 6–11 as a guide, remove the T-15 Torx® mounting screws securing the main board assembly to the chassis.
8. Lift the main board assembly away from the oscilloscope to complete its removal.

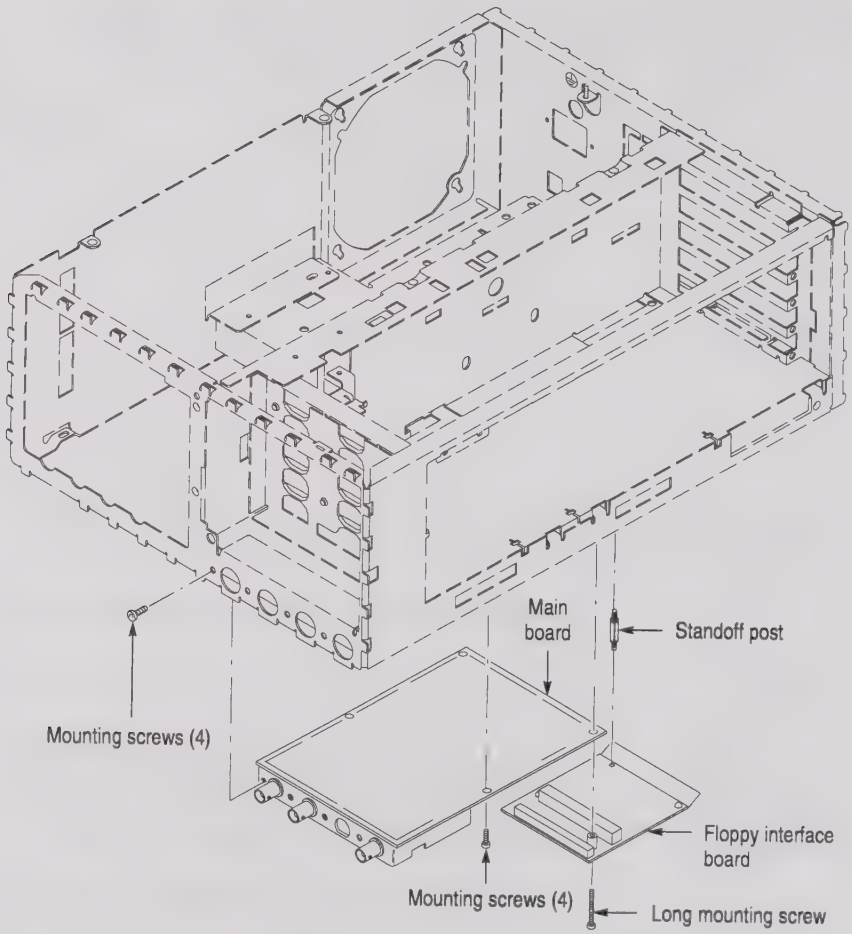

Figure 6–11: Removing the main board

9. *Reinstalling the main board:* Perform in reverse order steps 8 through 1, reversing the removal instructions in each substep to reinstall the assembly.

WARNING. *When reinstalling the floppy interface board with an Option 14 communications cable, make sure that you pull on the cable while tightening the interface board hold-down screw. Pulling the cable prevents it from getting pinched between the main processor board and the metal standoff post.*

Monitor Assembly

Required tool: a screwdriver with a size T-15 Torx® tip (Items 1 and 2).

1. Set the oscilloscope so its top is down on the work surface, with its front facing you.

WARNING. To avoid injury: *Use care when handling a monitor. If you break its display tube it may implode, scattering glass fragments with high velocity and possibly injuring you. Wear protective clothing, including safety glasses (preferably a full-face shield). Avoid striking the display tube with or against any object.*

To avoid damaging the monitor: *Store the monitor with its display tube face down in a protected location, placing it on a soft, nonabrasive surface to prevent scratching the face plate.*

2. Take the precautions outlined in the ***WARNING*** above. Refer to Figure 6–12 while doing the following steps.
3. Unplug the main board/power supply cable.
4. Remove the three T-15 Torx® screws securing the monitor assembly to the bottom of the main chassis. Rotate the oscilloscope so its bottom is down on the work surface.

WARNING. *To avoid injury or death, do not unplug the anode from the monitor when removing or replacing the monitor module.*

5. Remove the three T-15 Torx® screws securing the monitor assembly to the top of the chassis. (See Figure 6–12 to locate the screws.)
6. Push up on the left top tab lock on the trim ring and pull the left corner of the trim ring forward slightly.
7. Tilt the rear of the monitor assembly upward slightly. Slide the monitor assembly back in the main chassis until it stops (about 2 cm). Now lift it straight up out of the top of the main chassis to complete the removal.
8. While heeding the ***WARNING*** on monitor handling that immediately precedes step 2 of this monitor removal procedure, store the monitor assembly in a protected location. Place it face down on a soft, nonabrasive surface to prevent scratching the face plate.
9. *Reinstallation:* perform steps 3 through 7 in reverse order to reinstall the monitor assembly.

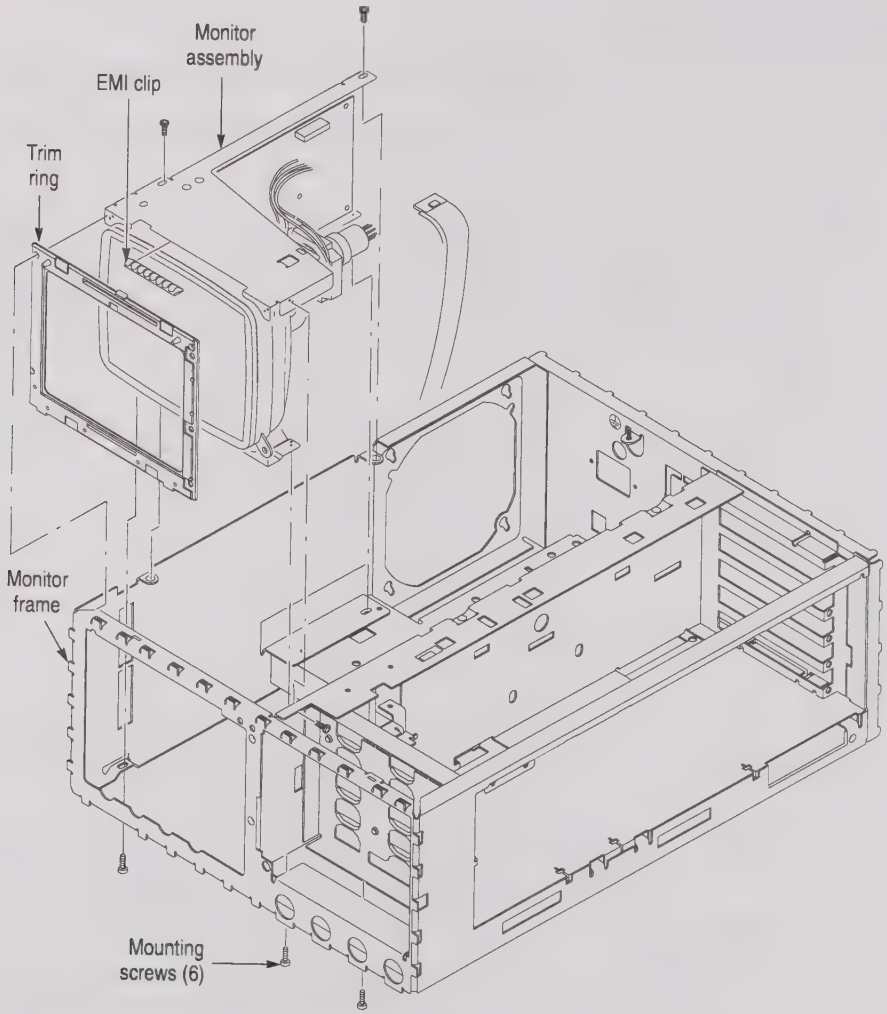

Figure 6–12: Monitor assembly removal

Power Supply Assembly

Required tool: a screwdriver with a size T-15 Torx® tip (Items 1 and 2).

1. Set the oscilloscope so its right side is down on the work surface, with its bottom facing you.
2. Unplug the main board power cable.
3. Set the oscilloscope so its bottom is down on the work surface, with its front facing to the right.
4. If Option 14 is installed and its printer power cable is used on your instrument, unplug the printer power cable.
5. Unplug the monitor and fan power cables.
6. Remove the chassis ground connector by unbolting it from the main chassis.
7. Remove the two screws connecting the power supply assembly to the main chassis (see Figure 6–13).
8. Gently pull the power supply assembly up and out of the main chassis.
9. *Reinstallation:* Perform steps 2 through 8 in reverse order, reversing the removal instructions in each step to reinstall the assembly.

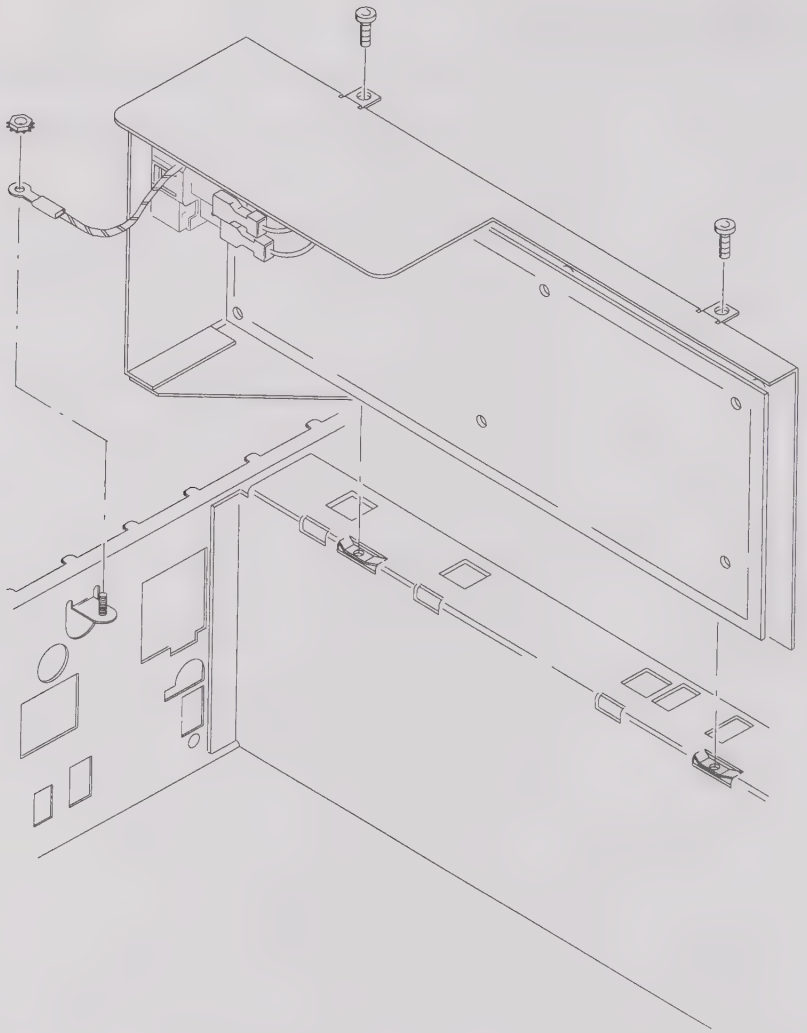

Figure 6–13: Low voltage power supply removal

Option 14 Assembly

Required tools: a screwdriver with a size T-15 Torx® tip (Items 1 and 2) and a 3/16 inch nut driver (Item 7).

1. Set the oscilloscope so its top is down on the work surface, with its front facing towards you.
2. Disconnect the main board communications cable (J601) *at the main board* or at the *floppy interface board*. Remove the cable from its cable clamp (see Figure 6–14). Refer to Page 6–18, step 3, for instructions on how to remove the floppy interface board.
3. Disconnect the video cable (J703) *at the main board.*
4. Remove the two screws connecting the assembly to the chassis (see Figure 6–14) using a screwdriver with a size T-15 Torx® tip.
5. Set the oscilloscope so its bottom is down on the work surface, with its rear facing towards you.
6. Disconnect power cable J4 from the power supply.
7. Using a screwdriver with a size T-15 Torx® tip, remove the two screws on the left side of the assembly (see Figure 6–14).
8. Now remove the two screws on the rear panel that fasten the assembly to the chassis.
9. Pull the assembly towards the front of the instrument and up and out of the chassis. Carefully route the cables through their holes in the chassis.
10. *Reinstallation:* Perform steps 9 through 2 in reverse order.

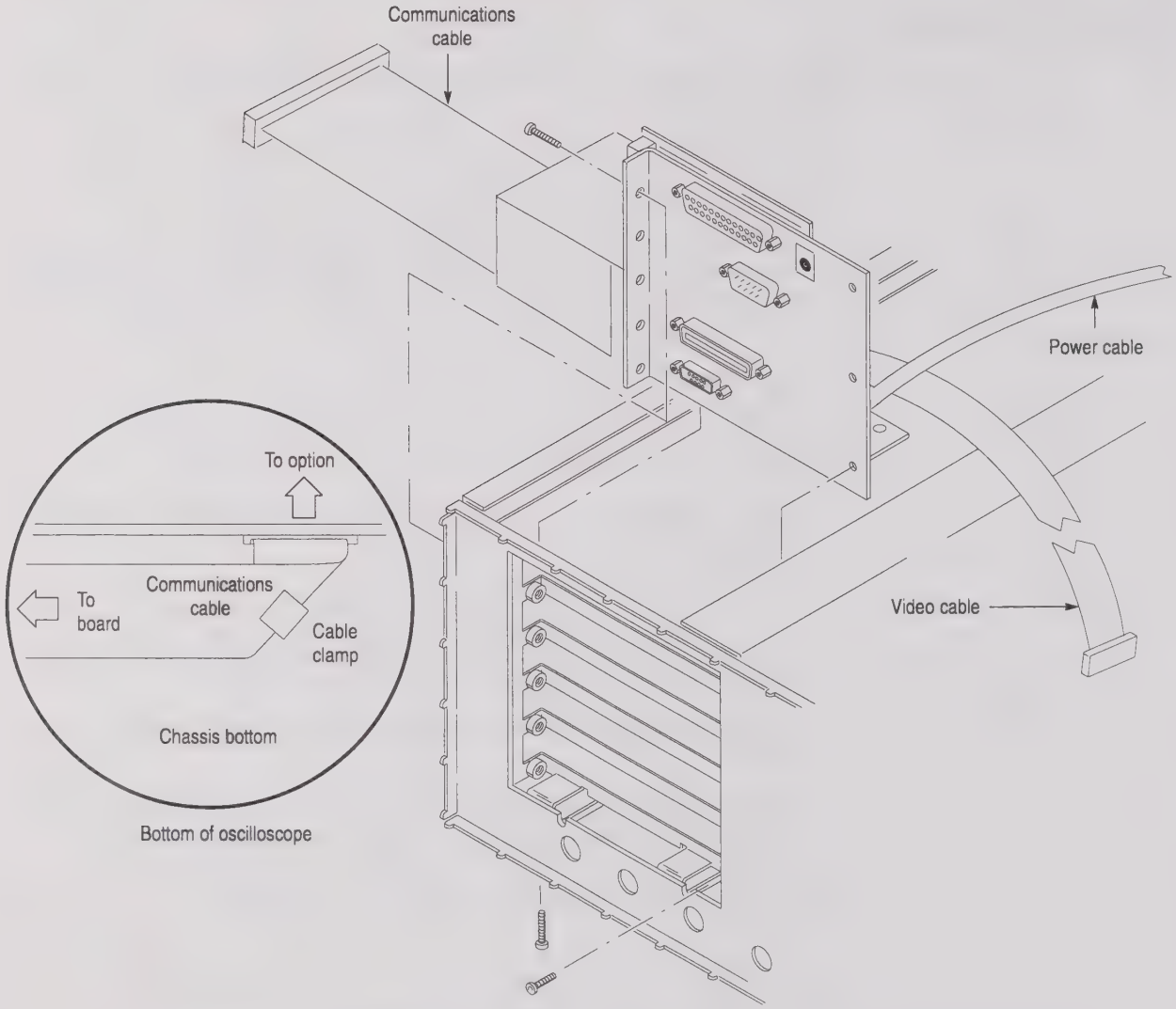

Figure 6–14: Option 14 assembly removal

Fan and Fan Mount

1. Set the oscilloscope so its bottom is down, with its rear facing you.
2. Unplug the *fan* power cable from J3 on the *Power Supply*.
3. Release the two flex locks securing the top of the fan to the fan mount, then lift the fan out from the top of the chassis (see Figure 6–15).

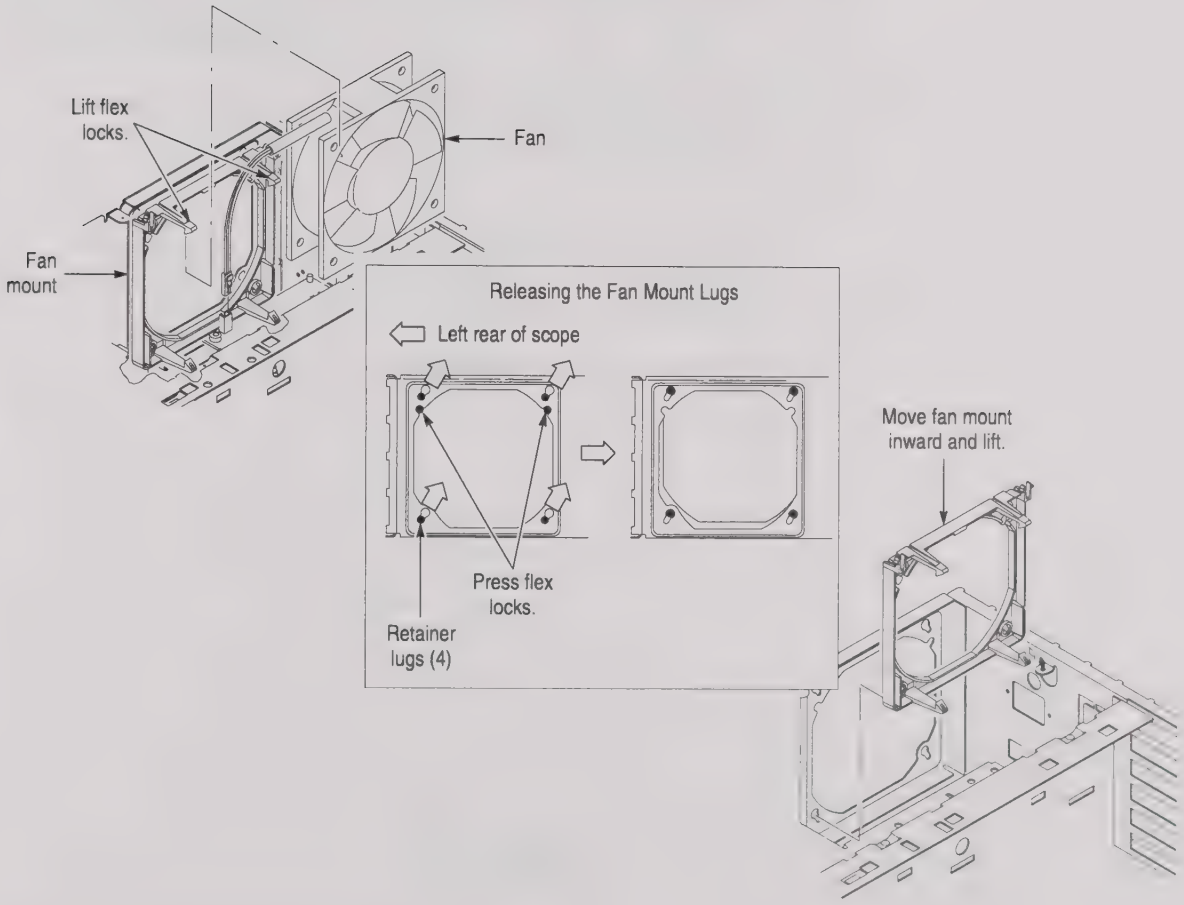

Figure 6–15: Fan and fan mount removal

STOP. *DO NOT proceed unless servicing a broken fan mount or removing that mount for cleaning.*

4. Rotate the oscilloscope so the side that houses the fan *mount* is facing upwards.
5. Depress the two flex locks to release them (see Figure 6–15).
6. While holding the flex locks released, slide the fan mount so its four retainer lugs slide from their small retainer holes in the chassis into their large release holes.
7. Move the fan mount inward so its retainer lugs are out of the large retainer holes and lift it out of the chassis to remove.
8. *Reinstallation:*
   a. Perform in reverse order steps 5 through 7, reversing the removal instructions in each substep to reinstall the fan mount. Be sure to seat the fan mount so its two flex locks snap to secure it on the chassis.
   b. Perform in reverse order steps 2 and 3 to reinstall the fan.

Troubleshooting

This section contains information and procedures designed to help you isolate faulty modules in the oscilloscope. If you need to replace a module, use the *Removal and Replacement* procedures immediately preceding this section.

Onboard Diagnostics

The onboard diagnostics focus on verifying, calibrating, and isolating faulty modules. Use the following procedure to activate the diagnostics.

1. Power up the oscilloscope and allow a 20 minute warm-up period.
2. Press the front panel button **UTILITY**.
3. Repeatedly press the main menu button **System** until **Diag** is highlighted in the pop-up menu. This calls up the diagnostics menu, shown in Figure 6–16.

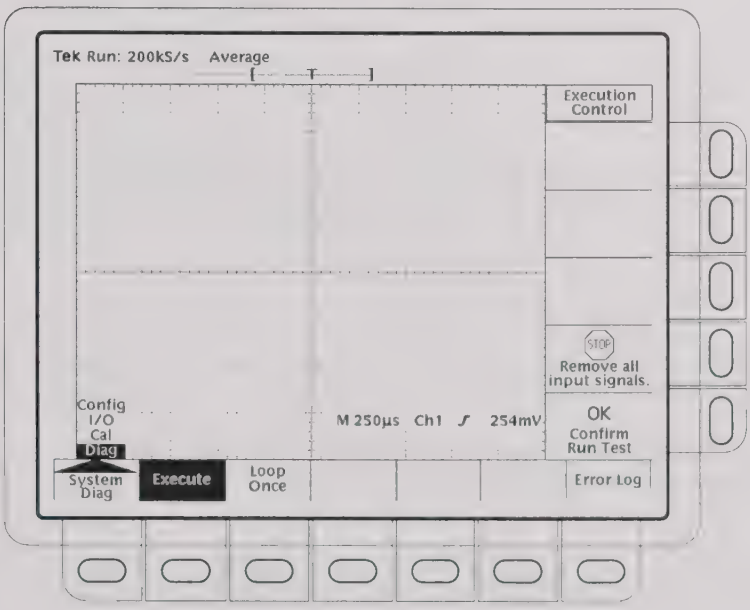

Figure 6–16: The diagnostics menu

4. Press the main menu button **Loop**. Select one of the following options from the side menu.
   - Press **Once** to run the tests once.
   - Press **Always** to run the tests continuously until you cycle the power.
   - Press **Until Fail** to run the tests continuously until the instrument fails a test or until you cycle the power.
5. Press the main menu button **Execute**; press the side menu button **Ok Confirm Run Test**.
6. Wait. The diagnostics will take about two minutes to complete. Then the oscilloscope displays pass/fail results for each system.
7. If the onboard diagnostics indicate a failure, reenter the diagnostics menu and press the main menu button **Error Log**.

NOTE. *The RS232 Line Snapshot and RS232 Errors are reset at each power-on. For more RS-232 information, refer to the* TDS 340A, TDS 360, & TDS 380 Programmer Manual.

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8. Press the side menu button **Display Log** to display the diagnostics error log. The error log contains summary data gathered over the life of the oscilloscope and descriptions of the last 200 errors encountered (see Figure 6–17). The last error in the list is the most recent and/or most important; record this information and continue on to the *Troubleshooting Procedure* in the next section to verify the failure and pinpoint the faulty module.

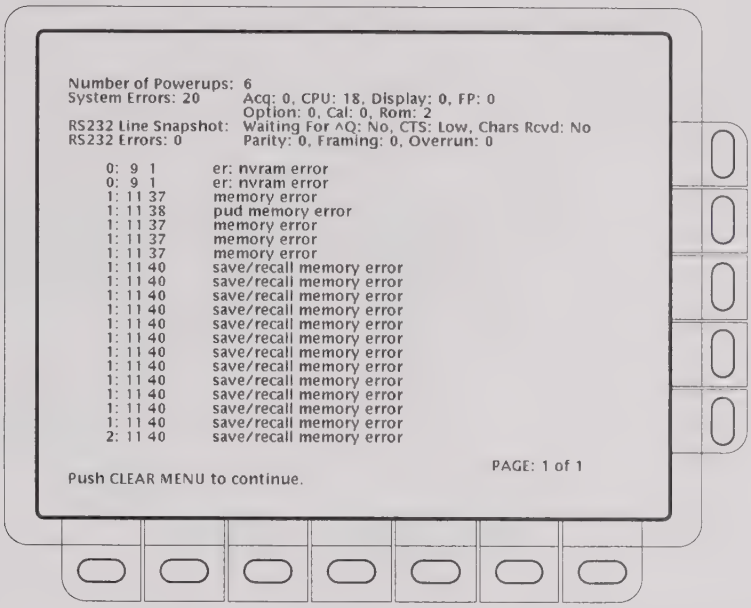

Number of Powerups: 6
System Errors: 20
Acq: 0, CPU: 18, Display: 0, FP: 0
Option: 0, Cal: 0, Rom: 2
RS232 Line Snapshot:
Waiting For ^Q: No, CTS: Low, Chars Rcvd: No
RS232 Errors: 0
Parity: 0, Framing: 0, Overrun: 0
0: 9 1 er: nvram error
0: 9 1 er: nvram error
1: 11 37 memory error
1: 11 38 pud memory error
1: 11 37 memory error
1: 11 37 memory error
1: 11 37 memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
1: 11 40 save/recall memory error
2: 11 40 save/recall memory error
PAGE: 1 of 1
Push CLEAR MENU to continue.

Figure 6–17: The error log

Enabling Calibration Menus

The Voltage, Timing, and External Trigger calibration menus are disabled at the factory. To enable the calibration menus, perform the following steps.

1. Remove the Line Cord as described on page 6–8.
2. Remove the Rear Cover and Cabinet as described on page 6–11.
3. Set the oscilloscope so its top side is down on the work surface and its front is facing you.
4. Remove cal jumper J609 from the main board (see Figure 6–18). Save the jumper. Reinstall the jumper after calibration to protect the calibration settings.
5. *Reinstallation:* Perform in reverse order steps 1 through 4, reversing the removal instructions in each substep.

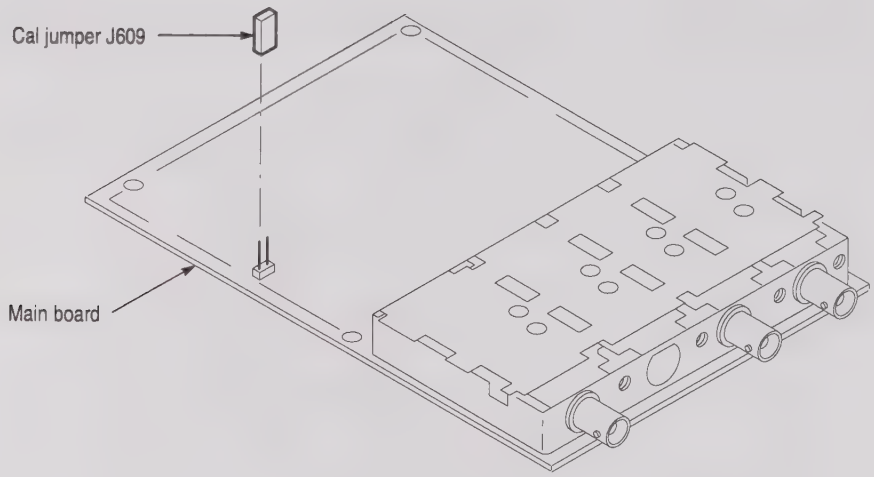


Figure 6–18: Main board cal jumper

Troubleshooting Procedure

Figures 6–19 through 6–22, 6–26, 6–28, and 6–29 are troubleshooting procedure flowcharts. Use them to verify module failures indicated by the onboard diagnostics, or use them to troubleshoot an instrument failure not connected with the diagnostics. Begin with Figure 6–19.

NOTE. *Before performing the troubleshooting procedure, remove the instrument cabinet (see page 6–11).*

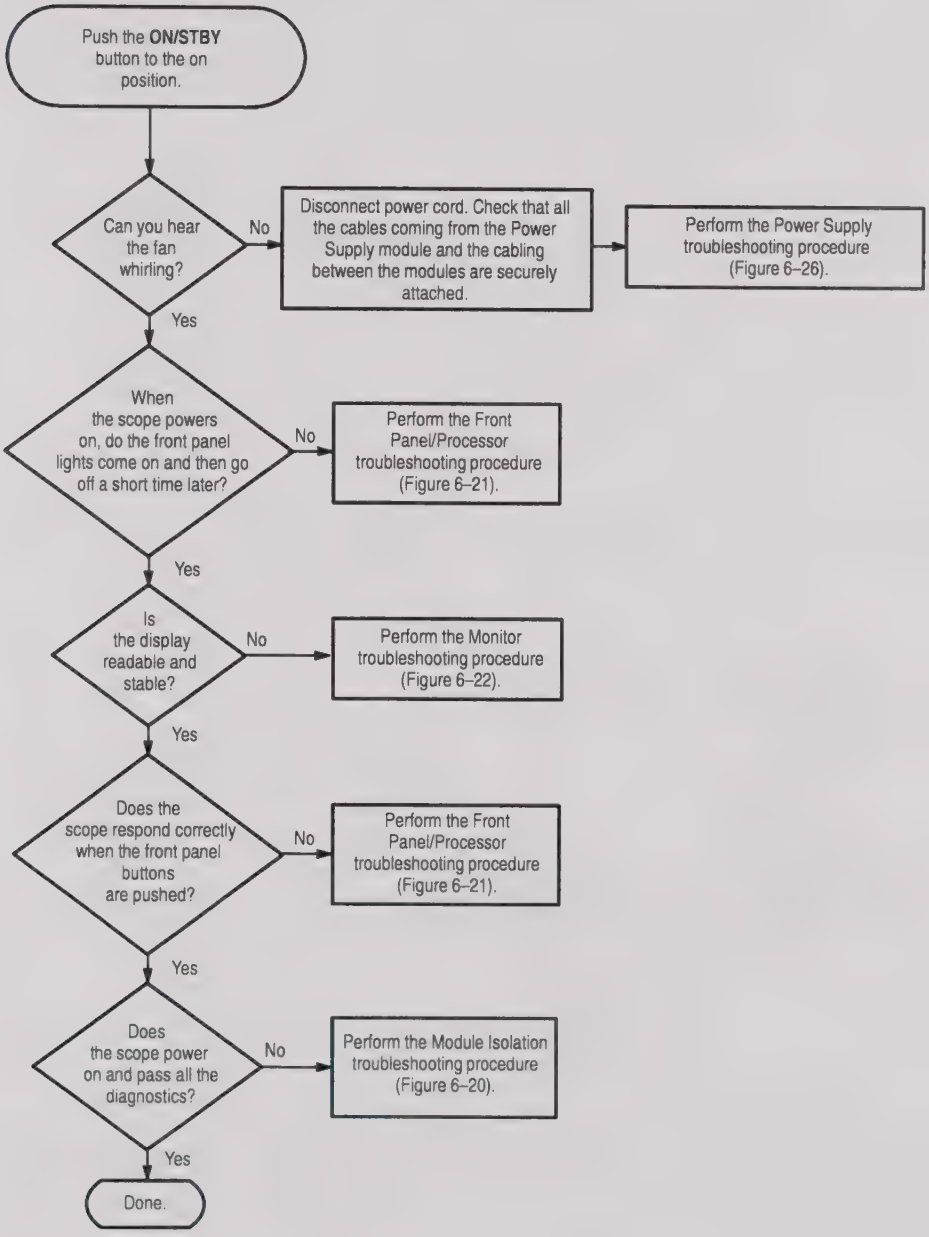

Push the ON/STBY button to the on position.
Can you hear the fan whirling?
No
Disconnect power cord. Check that all the cables coming from the Power Supply module and the cabling between the modules are securely attached.
Perform the Power Supply troubleshooting procedure (Figure 6–26).
Yes
When the scope powers on, do the front panel lights come on and then go off a short time later?
No
Perform the Front Panel/Processor troubleshooting procedure (Figure 6–21).
Yes
Is the display readable and stable?
No
Perform the Monitor troubleshooting procedure (Figure 6–22).
Yes
Does the scope respond correctly when the front panel buttons are pushed?
No
Perform the Front Panel/Processor troubleshooting procedure (Figure 6–21).
Yes
Does the scope power on and pass all the diagnostics?
No
Perform the Module Isolation troubleshooting procedure (Figure 6–20).
Yes
Done.

Figure 6–19: Primary troubleshooting procedure

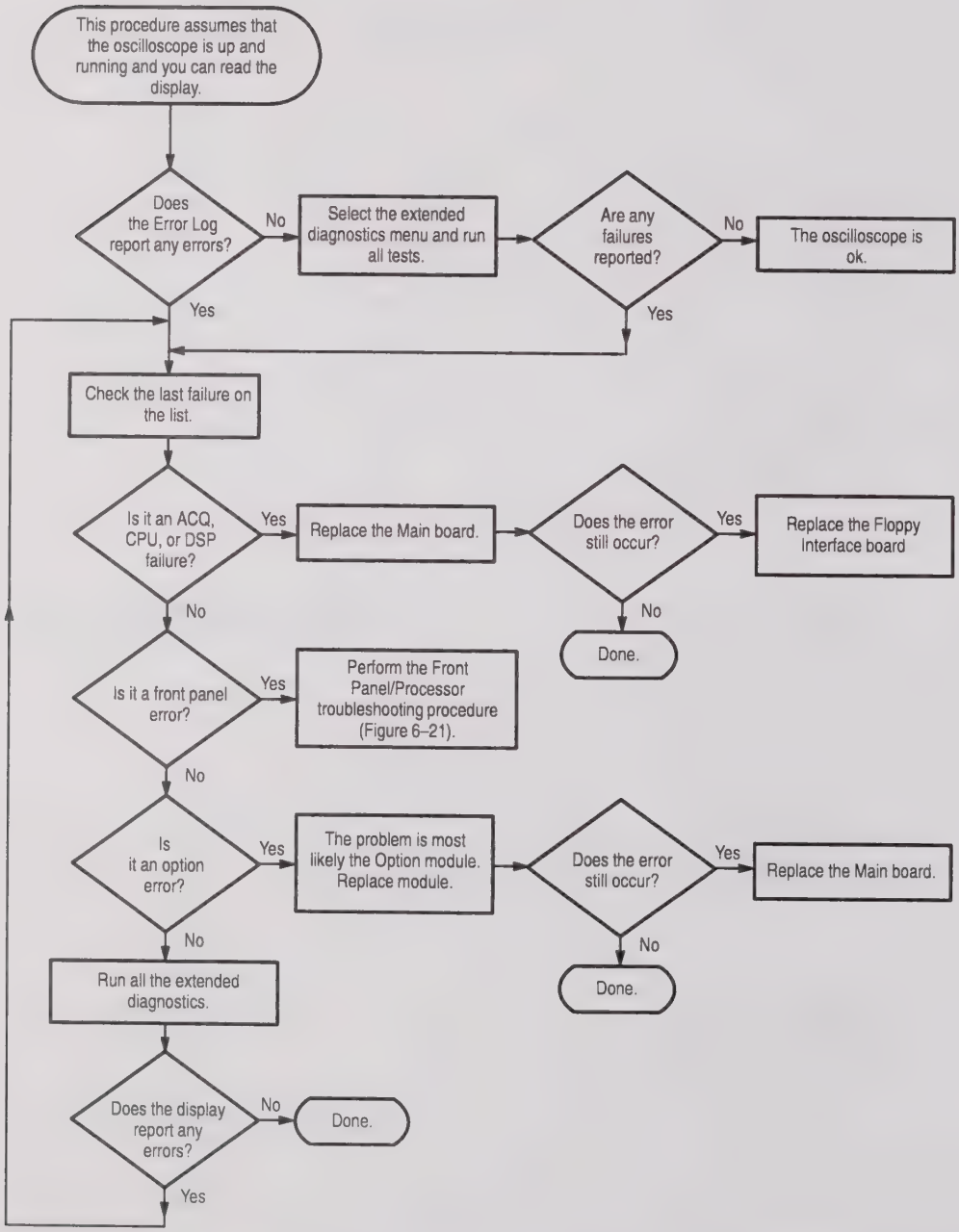


Figure 6–20: Module isolation troubleshooting procedure

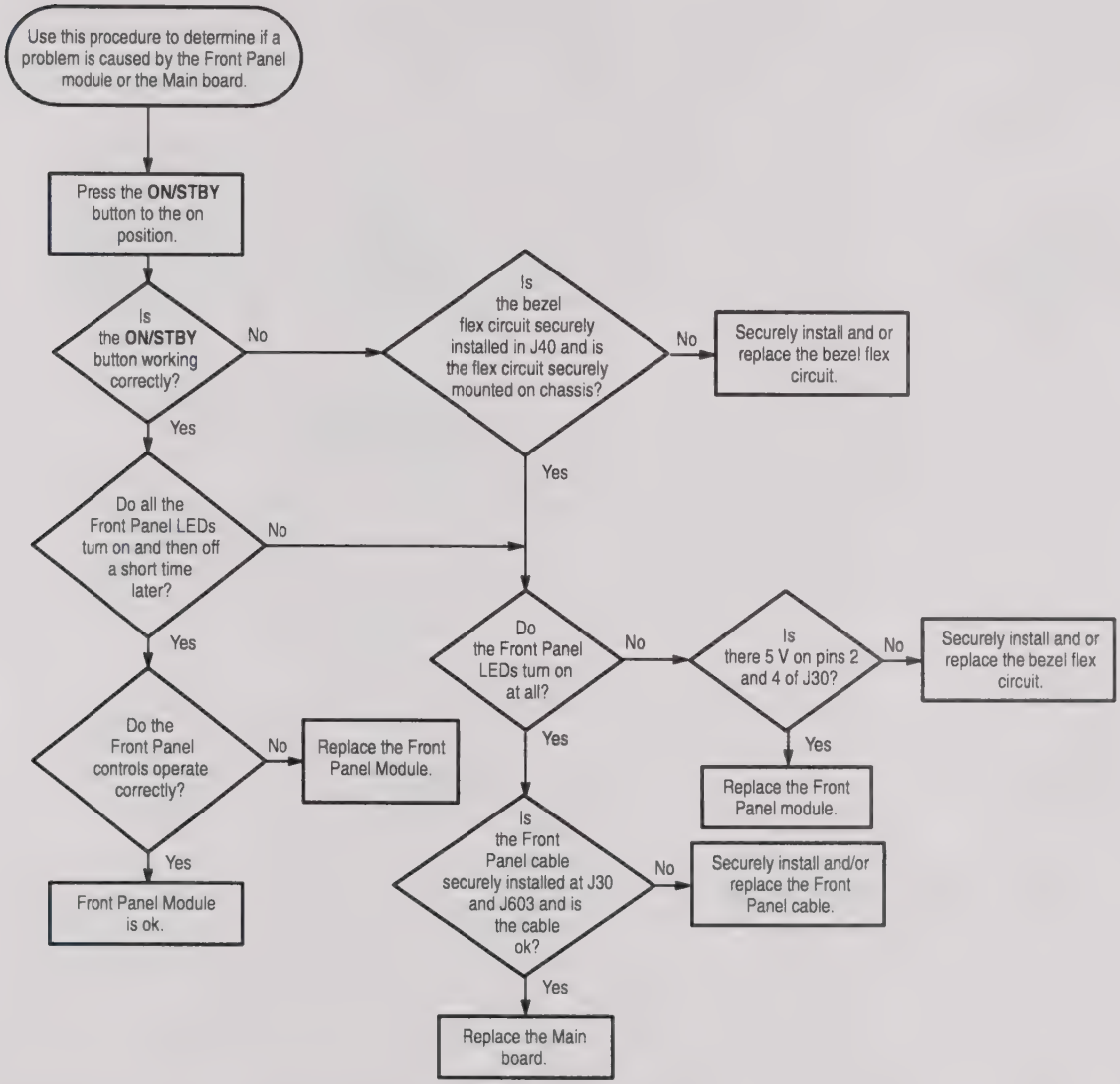

Use this procedure to determine if a problem is caused by the Front Panel module or the Main board.
Press the ON/STBY button to the on position.
Is the ON/STBY button working correctly?
No
Is the bezel flex circuit securely installed in J40 and is the flex circuit securely mounted on chassis?
No
Securely install and or replace the bezel flex circuit.
Yes
Yes
Do all the Front Panel LEDs turn on and then off a short time later?
No
Yes
Do the Front Panel controls operate correctly?
No
Replace the Front Panel Module.
Yes
Front Panel Module is ok.
Do the Front Panel LEDs turn on at all?
No
Is there 5 V on pins 2 and 4 of J30?
No
Securely install and or replace the bezel flex circuit.
Yes
Replace the Front Panel module.
Yes
Is the Front Panel cable securely installed at J30 and J603 and is the cable ok?
No
Securely install and/or replace the Front Panel cable.
Yes
Replace the Main board.

Figure 6–21: Front panel/processor troubleshooting procedure

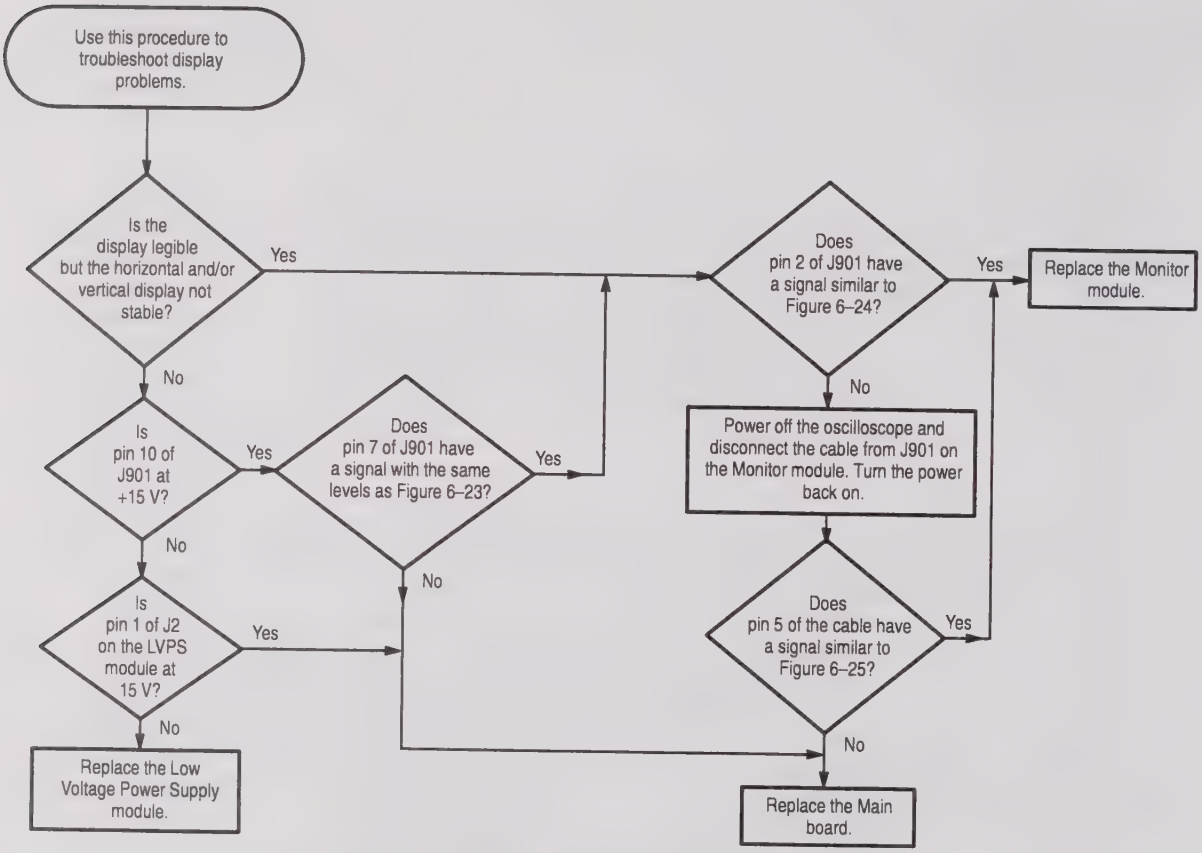

Use this procedure to troubleshoot display problems.
Is the display legible but the horizontal and/or vertical display not stable?
Yes
No
Does pin 2 of J901 have a signal similar to Figure 6–24?
Yes
Replace the Monitor module.
No
Power off the oscilloscope and disconnect the cable from J901 on the Monitor module. Turn the power back on.
Does pin 5 of the cable have a signal similar to Figure 6–25?
Yes
No
Is pin 10 of J901 at +15 V?
Yes
No
Does pin 7 of J901 have a signal with the same levels as Figure 6–23?
Yes
No
Is pin 1 of J2 on the LVPS module at 15 V?
Yes
No
Replace the Low Voltage Power Supply module.
Replace the Main board.

Figure 6–22: Monitor troubleshooting procedure

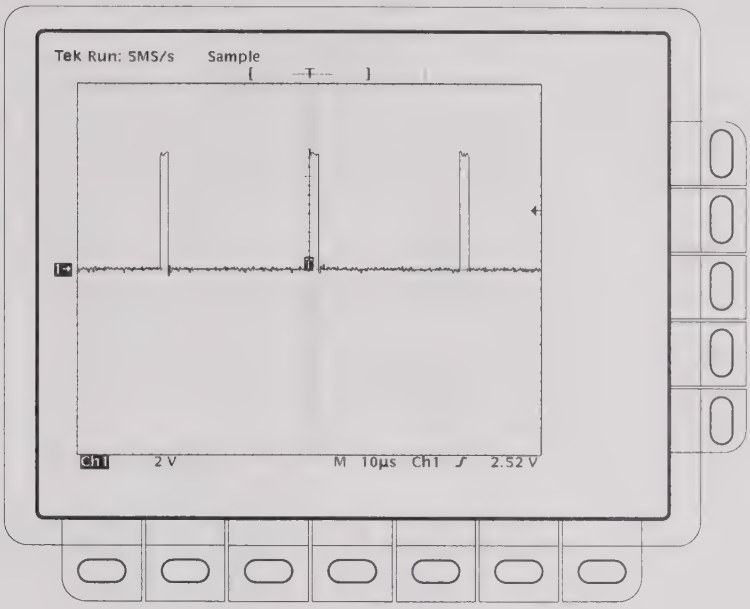


Figure 6–23: J901 pin 7 signal

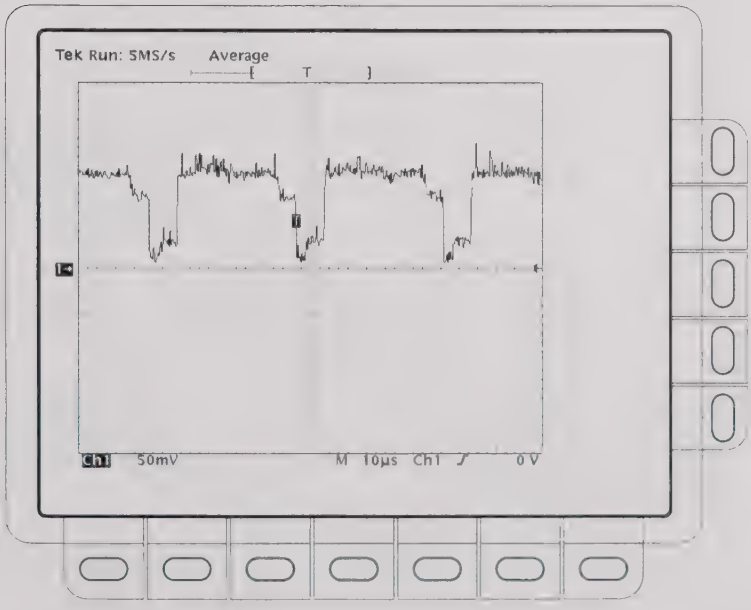


Figure 6–24: J901 pin 2 signal

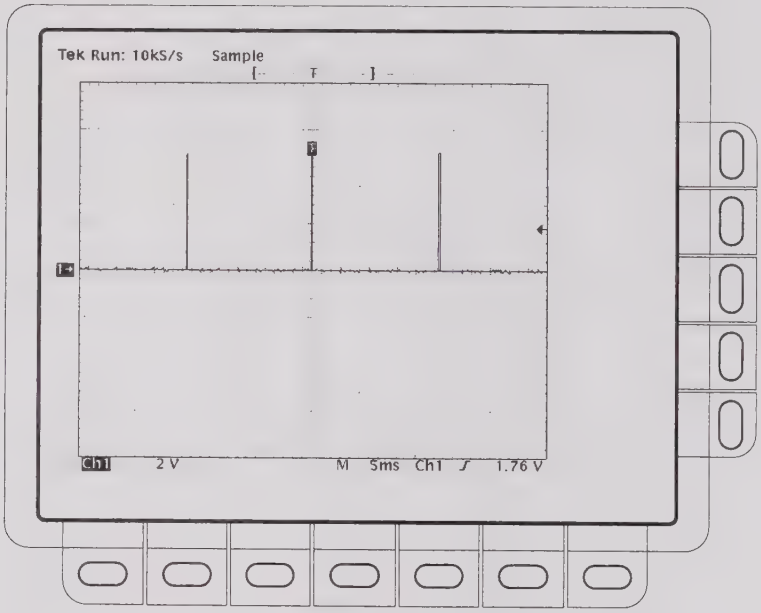


Figure 6–25: J901 pin 5 signal

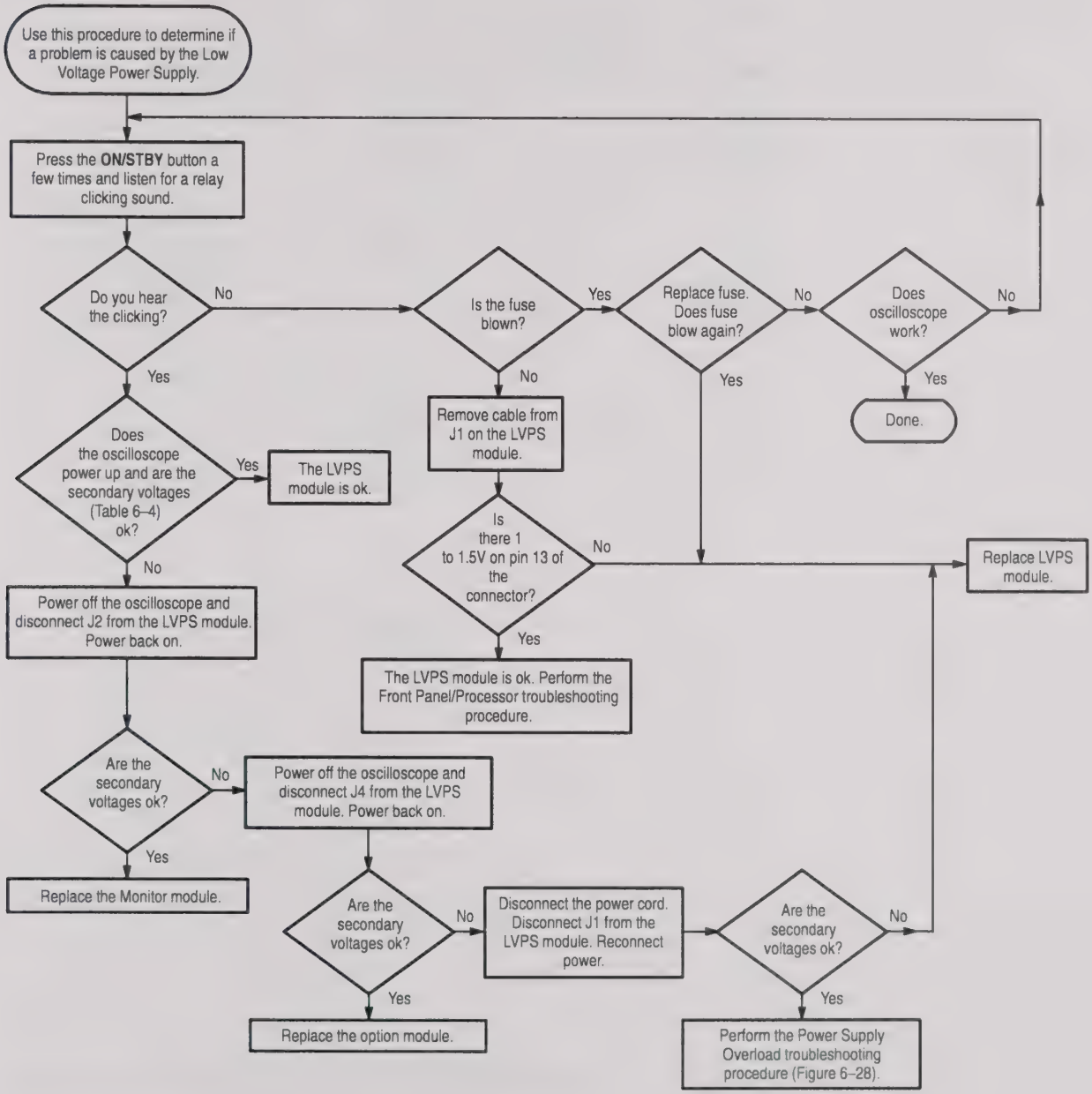

Use this procedure to determine if a problem is caused by the Low Voltage Power Supply.
Press the ON/STBY button a few times and listen for a relay clicking sound.
Do you hear the clicking?
No
Yes
Is the fuse blown?
Yes
No
Replace fuse. Does fuse blow again?
No
Yes
Does oscilloscope work?
No
Yes
Done.
Remove cable from J1 on the LVPS module.
Does the oscilloscope power up and are the secondary voltages (Table 6–4) ok?
Yes
The LVPS module is ok.
No
Power off the oscilloscope and disconnect J2 from the LVPS module. Power back on.
Is there 1 to 1.5V on pin 13 of the connector?
No
Yes
Replace LVPS module.
The LVPS module is ok. Perform the Front Panel/Processor troubleshooting procedure.
Are the secondary voltages ok?
No
Yes
Power off the oscilloscope and disconnect J4 from the LVPS module. Power back on.
Replace the Monitor module.
Are the secondary voltages ok?
No
Yes
Disconnect the power cord. Disconnect J1 from the LVPS module. Reconnect power.
Are the secondary voltages ok?
No
Yes
Replace the option module.
Perform the Power Supply Overload troubleshooting procedure (Figure 6–28).

Figure 6–26: Power supply troubleshooting procedure

Table 6–4: Power supply secondary voltages

Location (see Figure 6–27)	Minimum	Maximum
J1 pin 2	+8.38 V	+8.82 V
J1 pins 5 and 6	+4.87 V	+5.13 V
J1 pin 8	+4.87 V	+5.13 V
J1 pin 10	–8.38 V	–8.82 V
J1 pin 11	–4.87 V	–5.13 V
J1 pin 13, ON	+0.991 V	+1.137 V
J1 pin 13, STBY	+1.272 V	+1.406 V
J2 pin 1	+13.80 V	+15.75 V
J3 pin 1, fan connected	+10.20 V	+13.80 V
J3 pin 1, fan disconnected	+13.80 V	+15.75 V
J4 pin 1	+13.80 V	+15.75 V

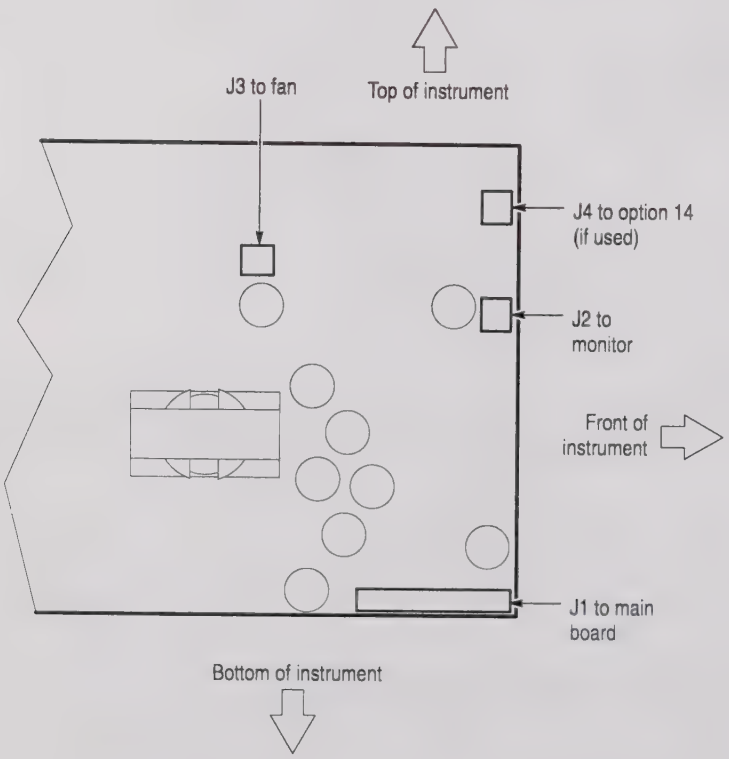


Figure 6–27: Power supply connector locations

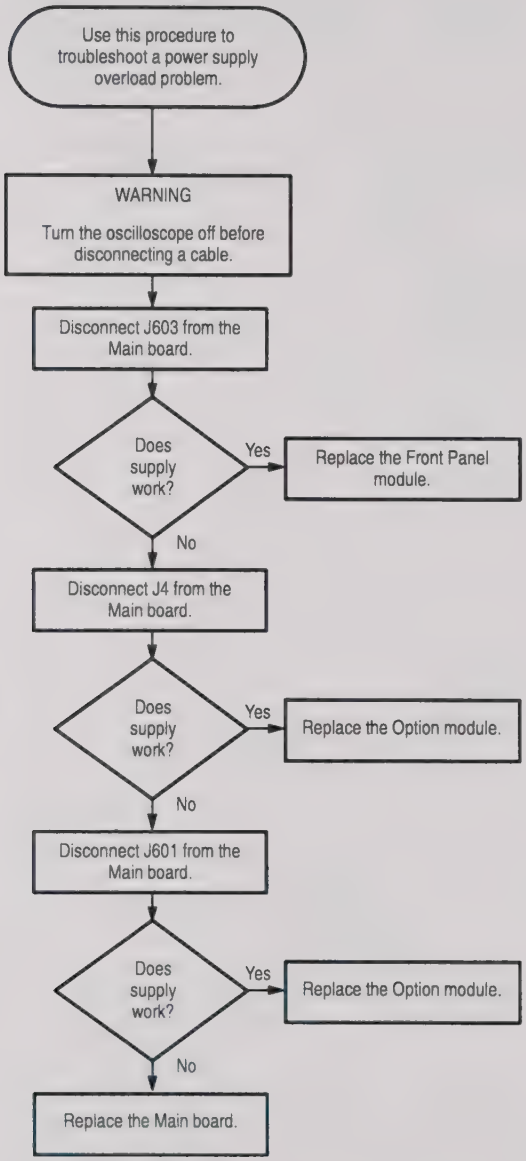


Figure 6–28: Power supply overload troubleshooting procedure

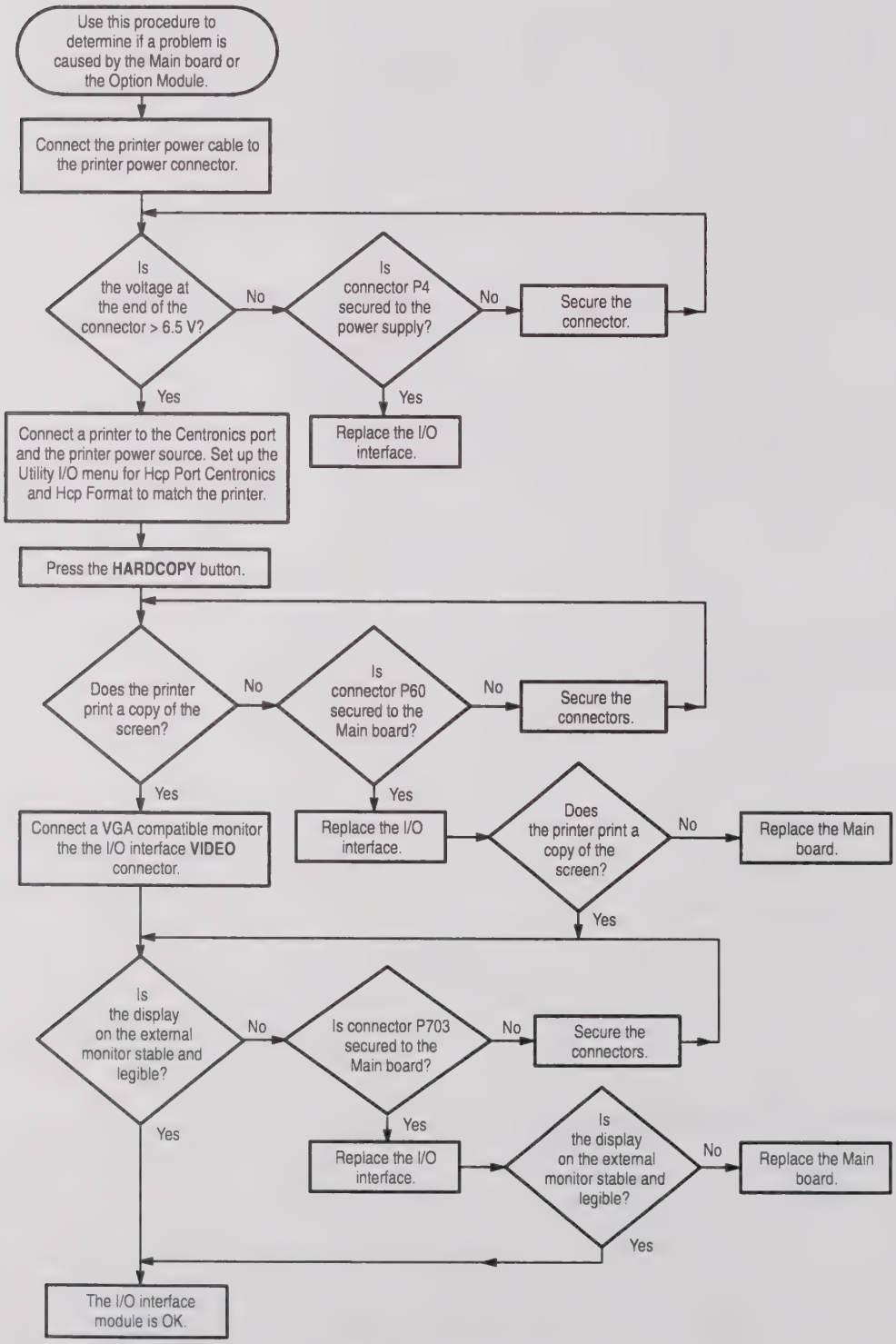

Use this procedure to determine if a problem is caused by the Main board or the Option Module.
Connect the printer power cable to the printer power connector.
Is the voltage at the end of the connector > 6.5 V?
No
Is connector P4 secured to the power supply?
No
Secure the connector.
Yes
Yes
Connect a printer to the Centronics port and the printer power source. Set up the Utility I/O menu for Hcp Port Centronics and Hcp Format to match the printer.
Replace the I/O interface.
Press the HARDCOPY button.
Does the printer print a copy of the screen?
No
Is connector P60 secured to the Main board?
No
Secure the connectors.
Yes
Yes
Connect a VGA compatible monitor the the I/O interface VIDEO connector.
Replace the I/O interface.
Does the printer print a copy of the screen?
No
Replace the Main board.
Yes
Is the display on the external monitor stable and legible?
No
Is connector P703 secured to the Main board?
No
Secure the connectors.
Yes
Yes
Replace the I/O interface.
Is the display on the external monitor stable and legible?
No
Replace the Main board.
Yes
The I/O interface module is OK.

Figure 6–29: Option 14 I/O interfaces troubleshooting procedure

Repackaging Instructions

If you ship the oscilloscope, pack it in the original shipping carton and packing material. If the original packing material is not available, package the instrument as follows:

1. Obtain a corrugated cardboard shipping carton with inside dimensions at least 15 cm (6 in) taller, wider, and deeper than the oscilloscope. The shipping carton must be constructed of cardboard with 170 kg (375 pound) test strength.
2. If you are shipping the oscilloscope to a Tektronix field office for repair, attach a tag to the oscilloscope showing the instrument owner and address, the name of the person to contact about the instrument, the instrument type, and the serial number.
3. Wrap the oscilloscope with polyethylene sheeting or equivalent material to protect the finish.
4. Cushion the oscilloscope in the shipping carton by tightly packing dunnage or urethane foam on all sides between the carton and the oscilloscope. Allow 7.5 cm (3 in) on all sides, top, and bottom.
5. Seal the shipping carton with shipping tape or an industrial stapler.

Options

This appendix describes the various options, as well as the standard and optional accessories, that are available for the TDS 340A, TDS 360, and TDS 380.

Options

The available options are the Option 14 I/O Interfaces, Options A1-A5 (international power cords), manual language options, and warranty service options. The following sections describe each of these options.

Option 14: I/O Interfaces

This option includes GPIB, RS-232, and Centronics interfaces, VGA video output, and power for the DPU 411 printer. It also includes the *TDS 340A, TDS 360 & TDS 380 Programmer Manual*.

You can connect a remote display to the VGA 9-pin D connector on the rear panel. Table 7–6 on page 7–4 gives the part number of a properly shielded cable that is commercially available.

Because display manufacturers use different pin combinations and connectors, you may find the information in Table 7–1 helpful.

Table 7–1: VGA output connector pins

Pin	Signal
2	Video (monochrome analog)
4	Horizontal sync @ 31.5 kHz (VGA rate)
5	Vertical sync
6, 7, 8	Ground

Options A1-A5: International Power Cords

Besides the standard North American, 110 V, 60 Hz power cord, Tektronix ships any of five alternate power cord configurations with the oscilloscope when ordered by the customer (see Table 7–2).

Table 7–2: International power cords

Option	Power Cord
A1	Universal European — 220 V, 50 Hz
A2	UK — 240 V, 50 Hz
A3	Australian — 240 V, 50 Hz
A4	North American — 240 V, 60 Hz
A5	Switzerland — 220 V, 50 Hz

Language Options

Language options provide user documentation in local languages (refer to Table 7–3 for options and manual part numbers):

Table 7–3: Language options

Language option	Language	User manual	Reference
Std	English	070-9459-00	070-9434-00
L1	French	070-9431-00	
L3	German	070-9432-00	
L4	Spanish	070-9433-00	
L5	Japanese	070-9440-00	070-9441-00
L7	Simple Chinese	070-9437-00	
L8	Standard Chinese	070-9438-00	
L9	Korean	070-9439-00	

Warranty-Plus Service Options

The following options add to the services available with the standard warranty. (The standard warranty appears immediately following the title page in this manual.)

- Option M2: Tektronix provides three years of warranty plus two years remedial service.
- Option M3: Tektronix provides three years of warranty plus two years remedial service and four oscilloscope calibrations.
- Option M8: Tektronix provides four calibrations and four performance verifications, one of each in the second through the fifth years of service.

Standard Accessories

The standard accessories listed in Table 7–4 come with the TDS 340A, TDS 360, and TDS 380. (Refer to Table 7–3 for manual part numbers.)

Table 7–4: Standard accessories

Accessory
Reference
User Manual
U.S. Power Cord
Probes (quantity two) P6109B 10X Passive (TDS 340A)
Probes (quantity two) P6111B 10X Passive (TDS 360)
Probes (quantity two) P6114B 10X Passive (TDS 380)

Optional Accessories

You can order the optional accessories listed in Table 7–5.

Table 7–5: Optional accessories

Accessory	Part number
Scope Camera	C-9, Option 4, (includes Adapter Hood 016-1154-01)
Oscilloscope Cart	K212
Rackmount Kit (for field conversion)	016-1166-00
Soft-Sided Carrying Case	016-1158-01
Carrying Case	016-0792-01
Deluxe Transit Case	016-1157-00
Front Cover	200-3232-02
Accessories Pouch	016-1159-00
I/O Interface Field Upgrade Kit	TD3F14A
Docuwave waveform capture utility software for the PC	S60 DWAV
Printer, bubble-jet, 360 dpi, 83 cps, plain paper	HC 220
Printer, portable thermal, 112 mm paper	DPU 411
Paper for DPU 411 printer, package of five rolls	006-7580-00
Programmer Manual	070-9442-00
Service Manual	070-9435-00

Accessory Probes

These are other types of probes you can use with the TDS 340A, TDS 360, and TDS 380. You can order the following probes separately:

- P6101B 1X Passive Probe
- P6129B Switchable 1X-10X Passive Probe (not recommended for the TDS 360 or TDS 380)
- P6408 TTL Logic Probe
- P5100 High Voltage Probe
- P5200 High-Voltage Differential Probe
- AM503S DC/AC Current Probe System
- P6561AS SMD Small-Geometry Probe

Accessory Cables

Table 7–6 lists cables you can use with the TDS 340A, TDS 360, and TDS 380. You can order them separately.

Table 7–6: Accessory cables

Cable type	Part number
GPIB,1 meter (3.3 feet)	012-0991-01
GPIB, 2 meter (6.6 feet)	012-0991-00
RS-232, 9-pin female to 9-pin female connectors, null modem, 76 inch (for AT style computers)	012-1379-00
RS-232, 9-pin female to 25-pin female connectors, null modem, 76 inch (for PC style computers)	012-1380-00
RS-232, 9-pin female to 25-pin male connectors, null modem, 9 feet (for serial interface printers)	012-1298-00
RS-232, 9-pin female to 25-pin male connectors, 15 feet (for modems)	012-1241-00
Centronics, 25-pin male to 36-pin Centronics, 2.4 meter (8 feet) (for parallel printer interfaces)	012-1214-00
NEC® VGA video cable. (Use an appropriate adapter when other than a 9-pin monitor connection is needed.)	73893029

Electrical Parts List

The modules that make up the TDS 340A, TDS 360, and TDS 380 are listed in Section 10, *Mechanical Parts List*, beginning on page 10-1.

Diagrams

The TDS 340A, TDS 360, and TDS 380 block/interconnect diagrams are shown in Figures 3–1 and 3–2, starting on page 3–2.

Mechanical Parts List

This section contains a list of the replaceable modules for the TDS 340A, TDS 360, and TDS 380. Use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order.

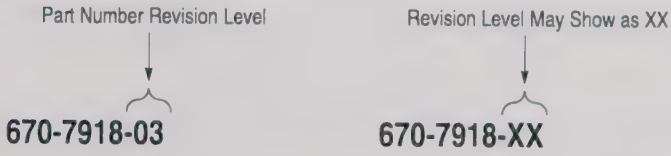
- Part number (see Part Number Revision Level below)
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If you order a part that has been replaced with a different or improved part, your local Tektronix field office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

Part Number Revision Level

Tektronix part numbers contain two digits that show the revision level of the part. For some parts in this manual, you will find the letters XX in place of the revision level number.



When you order parts, Tektronix will provide you with the most current part for your product type, serial number, and modification (if applicable). At the time of your order, Tektronix will determine the part number revision level needed for your product, based on the information you provide.

Module Servicing

Modules can be serviced by selecting one of the following three options. Contact your local Tektronix service center or representative for repair assistance.

Module Exchange. In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEK-WIDE, extension 6630.

Module Repair and Return. You may ship your module to us for repair, after which we will return it to you.

New Modules. You may purchase replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the TDS 340A, TDS 360, and TDS 380. Use this list to identify and order replacement parts. The following table describes each column in the parts list.

Parts List Column Descriptions

Column	Column Name	Description
1	Figure & Index Number	Items in this section are referenced by figure and index numbers to the exploded view illustrations that precede the list
2	Tektronix Part Number	Use this part number when ordering replacement parts from Tektronix
3 and 4	Serial Number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers
5	Qty	This indicates the quantity of parts used
6	Name & Description	An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification
7	Mfr. Code	This indicates the code of the actual manufacturer of the part
8	Mfr. Part Number	This indicates the actual manufacturer's or vendor's part number

Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1–1972.

Mfr. Code to Manufacturer Cross Index

The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC.	CUSTOMER SERVICE DEPT PO BOX 3608	HARRISBURG, PA 17105–3608
06383	PANDUIT CORP	17303 RIDGELAND AVE	TINLEY PARK, IL 60477–3048
06915	RICHCO	5825 N TRIPP AVE P.O. BOX 804238	CHICAGO, IL 60646
0J9P9	GEROME MFG CO INC	PO BOX 737 403 NORTH MAIN	NEWBERG, OR 97132
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 97214–4657
0KBZ5	Q & D PLASTICS INC	1812 – 16TH AVENUE PO BOX 487	FOREST GROVE, OR 97116–0487
1GM54	ZYTEC CORP	7575 MARKET PLACE DR	EDEN PRAIRIE, MN 55344
61058	MATSUSHITA ELECTRIC CORP OF AMERICA	PANASONIC INDUSTRIAL CO DIV TWO PANASONIC WAY	SECAUCUS, NJ 07094
61857	SAN–O INDUSTRIAL CORP	91–3 COLIN DRIVE	HOLBROOK, NY 11741
75915	LITTELFUSE INC	800 E NORTHWEST HWY	DES PLAINES, IL 60016–3049
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077–0001
86928	SEASTROM MFG CO INC	456 SEASTROM STREET	TWIN FALLS, ID 83301
TK1163	POLYCAST INC	9898 SW TIGARD ST	TIGARD, OR 97223
TK1943	NEILSEN MANUFACTURING INC	3501 PORTLAND RD NE	SALEM, OR 97303
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK HWY SUITE 2	VANCOUVER, WA 98661
07416	NELSON NAME PLATE COMPANY	3191 CASITAS AVENUE	LOS ANGELES, CA 90039–2410
0JR05	TRIQUEST PRECISION PLASTICS	3000 LEWIS & CLARK HWY PO BOX 66008	VANCOUVER, WA 98666–6008
0KB05	NORTH STAR NAMEPLATE INC	5750 NE MOORE COURT	HILLSBORO, OR 97124–6474
18565	CHOMERICS INC	77 DRAGON COURT	WOBURN, MA 01880
2W733	BELDEN WIRE & CABLE COMPANY	2200 US HWY 27 SOUTH PO BOX 1980	RICHMOND, IN 47374
50356	TEAC AMERICA INC	7733 TELEGRAPH RD PO BOX 750	MONTEBELLO, CA 90640–6537
64411	TECH–ETCH INC	100 RIGGENBACH ROAD	FALL RIVER, MA 02720
TK1326	NORTHWEST FOURSLIDE INC	18500 SW TETON AVENUE	TUALATIN, OR 97062
TK1908	PLASTIC MOLDED PRODUCT INC	4336 S ADAMS	TACOMA, WA 98409
TK1918	SHIN–ETSU POLYMER	34135 7TH ST	UNION CITY, CA 94587

Manufacturers Cross Index (Cont.)

Mfr. Code	Manufacturer	Address	City, State, Zip Code
S3109	FELLER U.S. CORPORATION	72 VERONICA AVE UNIT #4	SOMERSET, NJ 08873
TK1373	PATELEC–CEM	10156 TORINO VAICENTALLO 62/456	ITALY,
TK2541	AMERICOR ELECTRONICS LTD	UNIT–H 2682 W COYLE AVE	ELK GROVE VILLAGE, IL 60007
TK2548	XEROX CORPORATION	DIV OF XEROX CORPORATION 14181 SW MILLIKAN WAY	BEAVERTON, OR 97005
1DM20	PARLEX CORP	7 INDUSTRIAL WAY	SALEM, NH 03079
1JJ96	KAM ELECTRIC CO	11866 SLATER AVE NE	KIRKLAND, WA 98034
34416	PARSONS MANUFACTURING CORP	1055 O'BRIEN DRIVE	MENLO PARK, CA 940251476
6D224	HARBOR ELECTRONICS COMPANY	14500 S BROADWAY	GARDENA, CA 90248
TK2193	PHOTO & SOUND COMPANY	824 NW 18TH AVE	PORTLAND, OR 97209–2390
TK2500	SOLECTEK ACCESSORIES CORP	6370 NANCY RIDGE DRIVE UNIT 109	SAN DIEGO, CA 92121

Exploded Views

Figures 10–1 and 10–2 on the following pages show the module-level exploded views of the TDS 340A, TDS 360, and TDS 380 oscilloscope. The adjacent page is the list of components for that exploded view, indexed by the numbers in the figure.

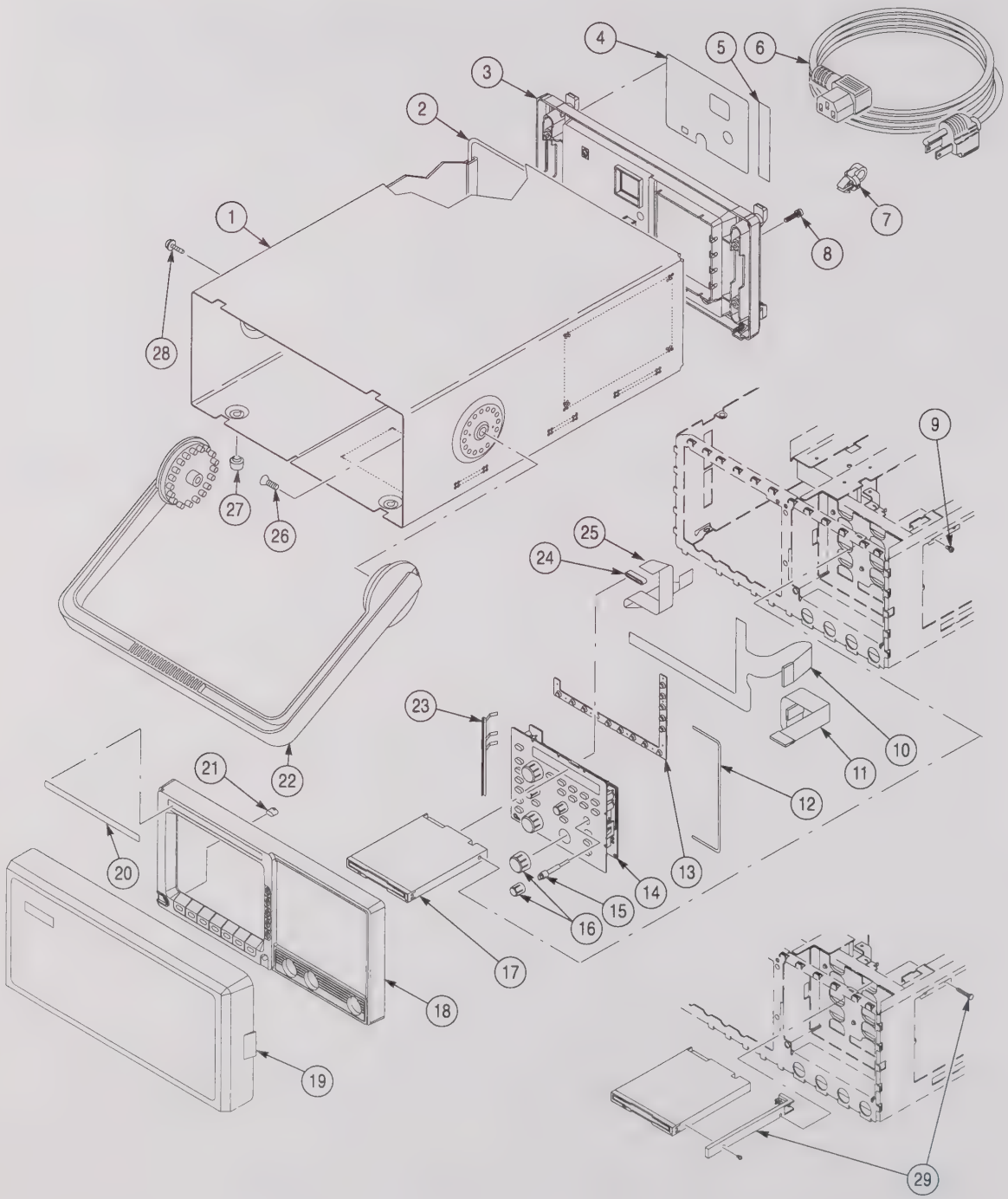


Figure 10–1: Cabinet and front panel assembly

Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10–1–1	390–1109–02			1	CABINET,SCOPE:ALUMINUM,TEK BLUE	80009	390–1109–02
–2	348–0764–04			1	SHLD GSKT,ELEK:0.125 X 0.188,WIRE MESH	18565	ORDER BY DESCR
–3	200–3971–05			1	REAR COVER ASSY,W/LABELS,TDS300	80009	200–3971–05
–4	334–8324–00			1	MARKER,IDENT:MKD REAR,PWR SUPPLY,WARNING	07416	334–8324–00
–5	334–8718–00			1	MARKER,IDENT:OPTION,TDS300	0KB05	334–8718–00
–6	161–0230–01			1	CABLE ASSY,PWR:3,18 AWG,TAN,60 DEG,10A/125V,	2W733	ORDER BY DESCR
–7	343–1213–00			1	CLAMP,PWR CORD:POLYMIDE	TK1163	ORDER BY DESCR
–8	211–0691–00			4	SCR,ASSEM WSHR:6–32 X 0.625,PNH,STL,T–15 TORX	0KB01	ORDER BY DESCR
–9	211–0840–00			2	SCREW,MACHINE:M2.6 X 0.45MM PITCH X 4.0MM L,PHILIPS	0KB01	.26C4MXPHY
–10	259–0086–00			1	FLEX CIRCUIT:BEZEL BUTTON	07416	ORDER BY DESCR
–11	174–2598–00			1	CA ASSY, FRONT PANEL:FLAT FLEX,FLX,16,26 AWG	TK2469	174–2598–00
–12	348–1258–00			4	SHLD,GASKET,ELE:2 LAYER,0.094 X 0.188 X 8.750	64411	348–1258–00
–13	260–2539–00			1	SWITCH,SET:ELASTOMERIC BEZEL,	TK1918	260–2539–00
–14	672–1454–00			1	CIRCUIT BD ASSY:FRONT PANEL ASSEMBLY,	80009	672–1454–00
–15	384–1689–00			6	SHAFT,EXTENDER:ACETAL	TK1163	ORDER BY DESCR
–16	020–2036–00			1	KNOB KIT:MINIATURE SIZE	80009	020–2036–00
–17	119–5677–01			1	DISK DRIVE:FLOPPY, 3.5 INCH, 1.44MB HD	50356	FD–04HF–2300
–18	101–0140–00			1	TRIM,DECORATIVE:FRONT	TK1163	ORDER BY DESCR
–19	200–3232–01			1	COVER, FRONT:ABS (OPTIONAL ACCESSORY)	TK1908	ORDER BY DESCR
–20	334–9118–00			1	MARKER,IDENT:LABEL,FRONT PANEL,TDS340A	0KB05	334–9118–00
	334–9119–00			1	MARKER,IDENT:LABEL,FRONT PANEL,TDS360	0KB05	334–9119–00
	334–9120–00				MARKER,IDENT:LABEL,FRONT PANEL,TDS380	0KB05	334–9120–00
–21	366–2164–00			35	PUSH BUTTON:SMOKE TAN	80009	366–2164–00
–22	367–0356–01			1	HANDLE,CARRYING:POLYCARBONATE LEXAN,SMOKE TAN	80009	367–0356–01
–23	131–5965–00			1	CONTACT,ELEC:ESD PROTECT,STAINLESS STEEL ALLOY	TK1326	131–5965–00
–24	276–0849–00			1	CORE,EM:EMI SUPPRESS,RBN CA,RECTANGULAR	1JJ96	33 FR 33.5 X 8 X 6.5
–25	174–3135–00			1	CABLE ASSY,SP:FLAT FLEX,FLX,26,1MM,15.0 L	1DM20	1.00MM–26–15–B
–26	212–0144–00			2	SCREW,TPG,TC:8–16 X 0.562 L,PLASTITE,SPCL HD,TORX	0KB01	ORDER BY DESCR
–27	348–0659–00			2	FOOT,CABINET:BLACK POLYURETHANE	0JR05	ORDER BY DESCR
–28	211–0730–00			1	SCR,ASSEM WSHR:6–32 X 0.375,PNH,STL,CDPL,T–15 TORX	0KB01	ORDER BY DESCR
–29	211–0866–00			1	SCREW PHIL M2.5X10 PHIL PNH BRZN	0KB01	211–0866–00
	105–1081–00			1	ADAPTER:FLOPPY DISK DRIVE BRACKET ADAPTER	TK1163	105–1081–00

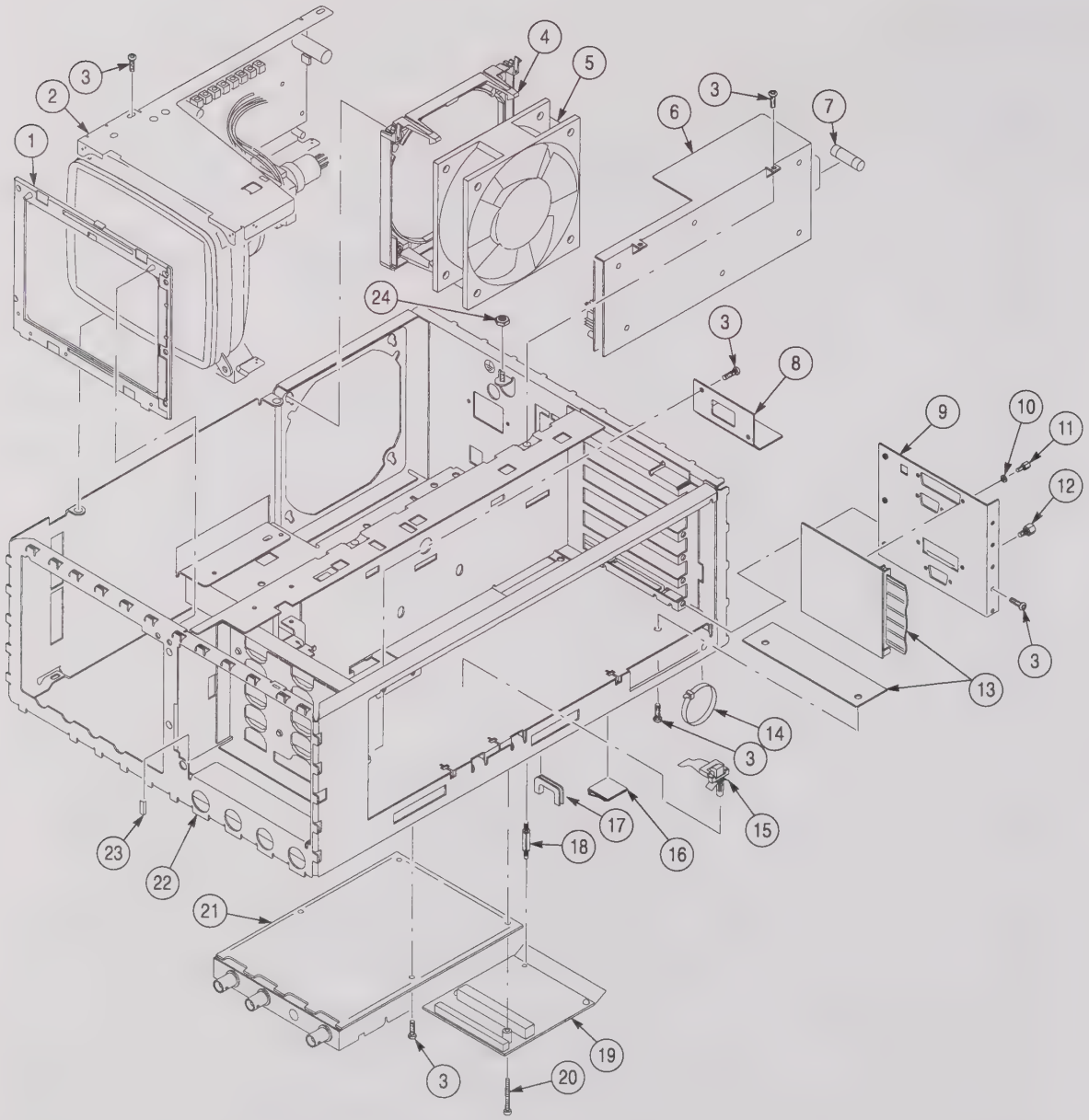


Figure 10–2: CRT, power supply, and circuit boards

Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10–2–1	426–2436–01			1	FRAME,CRT FLTR:POLYCARBONATE,BLACK,CT750	80009	426–2436–01
–2	640–0079–02			1	DISPLAY ASSY:7 INCH,480 X 640 PIXEL,MONOCHROME	80009	640–0079–02
–3	213–0882–00			22	SCREW,TPG,TR:6–32 X 0.437,PNH,STL,CDPL,T–15 TORX	0KB01	ORDER BY DESCR
–4	426–2426–00			1	FRAME,FAN MTG:POLYCARBONATE	TK1163	426–2426–00
–5	119–1770–04			1	FAN,DC:TUBEAXIAL,12V,2.0W,49.5 CFM,40 DBA,7.5" LEAD W/CONNECTOR,120MM X 120MM X 25.4MM,	61058	PANAFLO FBP–12A12L
–6	119–5029–02			1	POWER SUPPLY:44W,90–275VAC,97–440HZ	1GM54	22917399
–7	159–0190–00			1	FUSE,CARTRIDGE:5 X 20MM,3.15A,250V,50MS	61857	EQ–3.15A
	159–0277–00			1	FUSE,CARTRIDGE:5 X 20MM,3A,250V,5 SEC,UL LIST,CSA,	75915	235003
–8	407–4247–00			1	BRACKET:ALUMINUM,CABLE CLAMP,2.375 L	0J9P9	407–4247–00
–9	407–4196–00			1	BRACKET,STD:ALUMINUM (STANDARD)	TK1943	407–4196–00
	407–4293–00			1	BRKT,OPTION 14,0.050 AL ALLOY (OPT 14 ONLY)	TK1943	407–4293–00
–10	210–0056–00			2	WASHER,LOCK:#10 SPLIT,0.047 THK,SI BRZ NP	86928	ORDER BY DESCR
–11	213–1079–00			4	JACKSCREW:4–40 X 0.250EXTTHD,4–40 X 0.120 IN	00779	745563–2
–12	213–1061–00			2	JACKSCREW:6–32 X 0.320	00779	554043–3
–13	672–3140–01			1	CKT BD SUBASSY:OPTION 14 BD TDS300 SERIES	80009	672–3140–01
–14	343–0549–00			1	STRAP,TIEDOWN,E:0.098 W X 4.0 L,ZYTEL	06383	PLT1M
–15	343–1585–00			1	CLAMP:WIRE ROUTING CLAMP, NYLON	06915	HFCC–A–8–01
–16	343–0775–00			1	CLAMP:RIBBON CABLE CLAMP (OPT 14)	52152	80610029243/3484–1000
–17	348–0150–00			1	GROMMET,PLASTIC:DK GRAY,U–SHAPE,0.66 ID	0KBZ5	NA
–18	129–1480–00			1	SPACING SUPPORT POST, 0.710	06915	DLSP–3–18M–01
–19	671–3777–00			1	SUBASSY:FLOPPY DISK INTERFACE	80009	679–3777–00
–20	211–0712–00			1	SCR,ASSEM WSHR:6–32 X 1.250,T–15 TORX	0KB01	ORDER BY DESCR
–21	671–3736–00			1	CIRCUIT BD ASSY:MAIN BD,TDS 340	80009	671–3736–00
	671–3752–00			1	CIRCUIT BD ASSY:MAIN BD,TDS 360	80009	671–3752–00
	671–3753–00			1	CIRCUIT BD ASSY:MAIN BD,TDS 380	80009	671–3753–00
–22	441–2072–00			1	CHASSIS ASSY	80009	441–2072–00
–23	344–0513–00			1	SHIELD, GASKET:EMI CLIP,0.4L, 0.1W,0.074H,SST	80009	344–0513–00
–24	210–0457–00			1	NUT,PL,ASSEM WA:6–32 X 0.312,STL CD PL	0KB01	ORDER BY DESCR

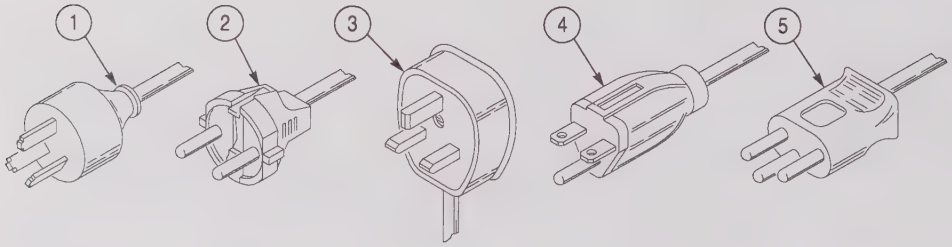


Figure 10–3: Accessories

Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					STANDARD ACCESSORIES		
10–3–1	161–0104–05			1	CABLE ASSY,PWR,:3,18 AWG,240V,98.0 L, (OPTION A3–AUSTRALIAN)	TK1373	161–0104–05
–2	161–0104–06			1	CABLE ASSY,PWR,:3 X 0.75MM SQ,220V,98.0 L (OPTION A1–EUROPEAN)	TK1373	ORDER BY DESC
–3	161–0104–07			1	CABLE ASSY,PWR,:3,1.0MM SQ,240 VOLT,2.5 M (OPTION A2–UNITED KINGDOM)	TK2541	ORDER BY DESC
–4	161–0104–08			1	CABLE ASSY,PWR,:3,18 AWG,98 L,SVT,GREY/BLK (OPTION A4–NORTH AMERICAN)	2W733	ORDER BY DESC
–5	161–0167–00			1	CABLE ASSY,PWR,:3.0 X 0.75,6A,240V,2.5M L (OPTION A5–SWITZERLAND)	S3109	ORDER BY DESC
	———			1	ACCY PKG:(2) P6109B PASSIVE PROBES W/ACCY (TDS340 ONLY)		ORDER BY DESC
	———			1	ACCY PKG:(2) P6111B PASSIVE PROBES W/ACCY (TDS360 ONLY)		ORDER BY DESC
	———			1	ACCY PKG:(2) P6114B PASSIVE PROBES W/ACCY (TDS380 ONLY)		ORDER BY DESC
	070–9459–00			1	MANUAL,TECH:USER ENGLISH	TK2548	070945900
	070–8690–01			1	MANUAL,TECH:USER,XYZ OF OSCILLOSCOPE	TK2548	070869001

Optional Accessories List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					OPTIONAL ACCESSORIES		
	012–0991–00			1	CABLE,COMPOSITE:IDC,GPIB:2 METER	00779	553577–3
	012–0991–01			1	CABLE,GPIB:LOW EMI,1 METER	00779	553577–2
	012–1241–00			1	CABLE ASSY, RS232, 9-PIN FEM TO 25-PIN MALE, MODEM	6D224	012–1241–00
	012–1250–00			1	CABLE, CENTRONIC, INTCON:SHLD CMPST,PARA	TK2193	CACC 3049
	012–1298–00			1	CABLE ASSY, RS232, 9-PIN FEM TO 25-PIN MALE, NULL MODEM, 9 FEET	TK2500	C294–9
	012–1379–00			1	CABLE ASSY:RS232, 9-PIN FEM TO 9-PIN FEM, NULL MODEM, 76 INCH	80009	012137900
	012–1380–00			1	CABLE ASSY:RS232, 9-PIN FEM TO 25-PIN FEM, NULL MODEM, 76 INCH	80009	012138000
	016–0792–01			1	CASE,CARRYING:24.5 X 16.5 X 11.5	34416	2416BE11
	016–1154–00			1	HOOD ASSEMBLY:	80009	016115400
	016–1157–00			1	CASE,CARRYING:26 X 22 X 12,HARD TRANSFER	34416	ORDER BY DESC
	016–1158–01			1	CASE,CARRYING:SOFT PADDED,OPTIONS	80009	016115801
	016–1159–00			1	POUCH:POUCH & PLATE,GPS SIZE	80009	016115900
	016–1166–00			1	RACKMOUNT KIT:	80009	016116600
	063–1702–03			1	TDS 300 SERIES I/O INTERFACES UPGRADE KIT (OPT 14)	80009	063170203
	070–9442–00			1	MANUAL,TECH:PROGRAMMER	80009	070944200
	070–9435–00			1	MANUAL,TECH:SERVICE	80009	070943500
	200–3232–00			1	COVER,FRONT:ABS (SEE FIGURE 10–1–19)		ORDER BY DESC

REV	DESCRIPTION OF CHANGE

PART NUMBER 119-5029-02

Attn:

Robert Schulz

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Tektronix

TEKTRONIX, INC.
P. O. BOX 500
BEAVERTON, OREGON U.S.A. 97077

[X] TEKTRONIX, INC. SAFETY CONTROLLED PART.

THE DRAWING TYPE DESIGNATION AND APPROVED SOURCES OF SUPPLY FOR THIS PART NUMBER ARE LISTED ON THE PURCHASED ITEMS SOURCE LIST (PISL).

DWG/WR	KEN BUEHNER	DATE 30 NOV 95
COMP ENGR	JIM WILLIAMSON	DATE
CHRG/COORD		DATE
DESIGN ENGR		DATE

MATERIAL

FINISH

TITLE

POWER SUPPLY: 55W; +15V 2.1A, +8.6V 0.15A, +5VD 1.5A, +5VA 1A, −5VA 1A, −8.6V 0.5A; 90−132 VAC, 47−440 Hz; 90−275 VAC, 47−63 Hz; 114 x 67 x 272 mm

TEKTRONIX, INC. BEAVERTON, OREGON	SHT 1 OF 14	CODE IDENT NO 80009	SIZE A	PART NUMBER 119-5029-02	REV

DO NOT SCALE DRAWING

7.4 PRODUCTION CUMULATIVE DEFECT LEVEL

[Incoming Defect Level]: 0.15% (maximum) at first turn on at Tektronix
[Outgoing Defect Level]: 0.30% (maximum) through Tektronix manufacturing process

5.6.3. MAINS VOLTAGE INTERRUPTION IMMUNITY

1/2 cycle at 90 VRMS, 50 Hz: Performance Criteria A

5.6.4. MAINS "IN RANGE" VOLTAGE DIP AND SWELL IMMUNITY

≤ 20% step for ≤ 500 msec. within specified operating range
Performance Criteria A

5.6.5. MAINS FREQUENCY TRANSIENT IMMUNITY

≤ 5% change for ≤ 500 msec. within specified operating range
Performance Criteria A

5.6.6. MAINS STEADY UNDERVOLTAGE DURABILITY

0 to 90 VAC RMS
Power Monitor control signals may transition and output voltages may subsequently go low.
Performance Criteria B

5.6.7. MAINS STEADY OVERVOLTAGE DURABILITY

275 to 300 VAC RMS
Performance Criteria B

5.7 ELECTRO-STATIC DISCHARGE IMMUNITY (INSTALLED-IN-SYSTEM)

10 kV air discharge, using IEC 801-2/1984
Performance criteria A
18 kV air discharge, using IEC 801-2/1984
Performance criteria C

6 SAFETY SPECIFICATIONS

6.1 SAFETY AGENCY APPROVALS

6.1.1. UNDERWRITERS LABORATORIES

The power supply module shall be approved as a recognized component power supply under UL1244 standard, "Elecrical and Electronic Measuring and Testing Equipment".

At some time in the future it is anticipated that the following paragraph will be required and will supercede the previous paragraph.

The power supply module shall be approved as a recognized component power supply under the UL1950 standard, "Safety of Information Technology Equipment, including Electrical Business Equipment", with no D3 deviations. Recognition shall be by Underwriters's Laboratories.

6.1.2. CANADIAN STANDARDS ASSOCIATION

The power supply module shall be certified as a component power supply under the CAN/CSA – C22.2 No. 234 Series M90 standard, "Safety of Component Power Supplies".

6.1.3. INTERNATIONAL ELECTROTECHNICAL COMMISSION

The power supply module shall be certified by TUV to comply with EN 60950 / 06.88, EN 60950 A1 / 08.90, EN 60950 A2 / 10.91 standard.

At some time in the future it is anticipated that the following paragraph may be required and may supercede the previous paragraph.

REV	DESCRIPTION OF CHANGE

PART NUMBER 119-5029-02

Attn:

Robert Schulz

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COMP ENGR	JIM WILLIAMSON	DATE
CHGRY COORD		DATE
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TEKTRONIX, INC. BEAVERTON, OREGON	SHT 1 OF 14	CODE IDENT NO 80009	SIZE A	PART NUMBER 119−5029−02	REV

DO NOT SCALE DRAWING

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1/2 cycle at 90 VRMS, 50 Hz: Performance Criteria A

5.6.4. MAINS "IN RANGE" VOLTAGE DIP AND SWELL IMMUNITY

≤ 20% step for ≤ 500 msec. within specified operating range
Performance Criteria A

5.6.5. MAINS FREQUENCY TRANSIENT IMMUNITY

≤ 5% change for ≤ 500 msec. within specified operating range
Performance Criteria A

5.6.6. MAINS STEADY UNDERVOLTAGE DURABILITY

0 to 90 VAC RMS
Power Monitor control signals may transition and output voltages may subsequently go low.
Performance Criteria B

5.6.7. MAINS STEADY OVERVOLTAGE DURABILITY

275 to 300 VAC RMS
Performance Criteria B

5.7 ELECTRO-STATIC DISCHARGE IMMUNITY (INSTALLED-IN-SYSTEM)

10 kV air discharge, using IEC 801-2/1984
Performance criteria A
18 kV air discharge, using IEC 801-2/1984
Performance criteria C

6 SAFETY SPECIFICATIONS

6.1 SAFETY AGENCY APPROVALS

6.1.1. UNDERWRITERS LABORATORIES

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At some time in the future it is anticipated that the following paragraph may be required and may supercede the previous paragraph.

5.4 DYNAMICS ENVIRONMENT

5.4.1. RANDOM VIBRATION

[Operating]: 10 minutes each axis @ 0.0002 g^2/Hz PSD from 5 to 500 Hz:
Performance Criteria A
[Non-Operating]: 10 minutes each axis @ 0.02 g^2/Hz PSD from 5 to 500 Hz:
Performance Criteria B

5.4.2. FUNCTIONAL SHOCK

30-g's, half-sine 11-mSec duration, three shocks on each face, for a total of 18 shocks,
Performance Criteria A

5.5 ELECTROMAGNETIC COMPATIBILITY

5.5.1. INTERNAL CHASSIS NOISE AND EM RADIATION

Power supply module shall not produce internal interference to the extent that system performance is reduced below the acceptable level for system performance.

5.5.2. CONDUCTED EMISSIONS (INSTALLED-IN-SYSTEM)

6db margin below the limits (maximum) for:

EN60555-2, Mains Current Harmonics

FCC 47 CFR, part 15, Subpart B, Class A, Conducted Emissions

EN55022, Class B, Conducted Emissions

5.5.3. CONDUCTED SUSCEPTIBILITY (INSTALLED-IN-SYSTEM)

See "Power Line Disturbance Immunity" section below

5.5.4. RADIATED EMISSIONS (INSTALLED-IN-SYSTEM)

6 db margin below the limits (maximum) for:

FCC 47 CFR, Part 15, Subpart B, Class A, Radiated Emissions

EN55022, Class B, Radiated Emissions

5.5.5. RADIATED SUSCEPTIBILITY (INSTALLED-IN-SYSTEM)

IEC 801-3, Radiated Immunity

Performance Criteria A

5.6 POWER LINE DISTURBANCE IMMUNITY

5.6.1. MAINS VOLTAGE AMPLITUDE SURGE IMMUNITY (INSTALLED-IN-SYSTEM)

IEC TC 65(Secretariat)137 (proposed IEC 801-5)
Combination Wave,1.2/50 us - 8/20 us
2 kV common modes, 1 kV differential mode: Performance Criteria A

5.6.2. MAINS VOLTAGE FAST TRANSIENTS IMMUNITY (INSTALLED-IN-SYSTEM)

1KV, 5/50 waveform, 5KHz rep frequency, using IEC 801-4
Performance Criteria A

Drawing of salient dimensions and physical attributes goes here:
- outline dimensions including module mounting points
- clearances and keep aways for proper operation
- connector locations with pin 1 indicated
- required cooling air direction

5 ENVIRONMENTAL SPECIFICATIONS

5.1 STAND-ALONE VS INSTALLED-IN-SYSTEM

Enviromental specifications, unless otherwise stated, apply to the power supply module assembled into a Qualification Test Fixture. Some specifications are only valid "Installed - In-System" meaning the end use system and are indicated as such.

5.2 PERFORMANCE CRITERIA FOR IMMUNITY AND SUSCEPTIBILITY TESTING

[Performance Criteria A]: (no observed change)
The apparatus shall continue to operate as intended.
No degradation of performance or loss of function is allowed.
No permanent damage is permitted.

[Performance Criteria B]: (minor upset)
The apparatus shall continue to operate as intended after the test.
Some degradation of performance is allowed during the test (on Tekronix approval).
No change of actual operating state or stored data is allowed.
No permanent damage is permitted.

[Performance Criteria C]: (critical upset)
Temporary loss of function is allowed, provided the loss of function is self recoverable by the operation of the controls (including replacing mains fuse).
No permanent damage other than an open mains fuse is permitted.

5.3 ATMOSPHERIC ENVIRONMENT

5.3.1. TEMPERATURE

[Operating]: -10 °C to +65 °C
(This allows a 10 °C local temperature rise over system ambient of 55 °C.)
[Non-Operating]: -51 °C to +75 °C
Performance Criteria A

5.3.2. HUMIDITY

0 to 95 %RH at 40 °C or less, non-condensing
0 to 75 %RH at 55 °C or less, non-condensing
Performance Criteria A

5.3.3. ALTITUDE

[Operating]: 15,000 ft. (maximum): Performance Criteria A
[Non-Operating]: 40,000 ft. (maximum): Performance Criteria B

5.3.4. CONDENSED SURFACE MOISTURE

Load protecting fault sensing and limit/shutdown circuitry must remain operational.
During 20 minute warm-up period: Performance Criteria B
After 20 minute warm-up period: Performance Criteria A

4.6 OUTPUT CONNECTORS

4.6.1. MAIN OUTPUT (J1)

Amp Inc. model 1–103670–2, gold on nickel contact surface

Pin Number	Description
1	Line Trigger
2	+8.6 V
3	Return
4	Return
5	+5 VD
6	+5 VD
7	Return
8	+5 VA
9	Return
10	−8.6 V
11	−5 V
12	Reserved
13	On/Standby

4.6.2. MONITOR (J2)

Amp Inc. model 103670–1, gold on nickel contact surface

Pin Number	Description
1	+15 V
2	Return

4.6.3. FAN (J3)

Amp Inc. model 103670–1, gold on nickel contact surface

Pin Number	Description
1	Fan Power
2	Return

4.6.4. PRINTER (J4)

Amp Inc. model 103670–1, gold on nickel contact surface

Pin Number	
1	+ 15V
2	Return

4.6.5. DRAWING

To be added later. For now, consult design engineering with questions on physical attributes.

4.2 MARKINGS AND LABELS

4.2.1. MARKING DURABILITY AND LEGIBILITY

All markings shall be legible and permanent.

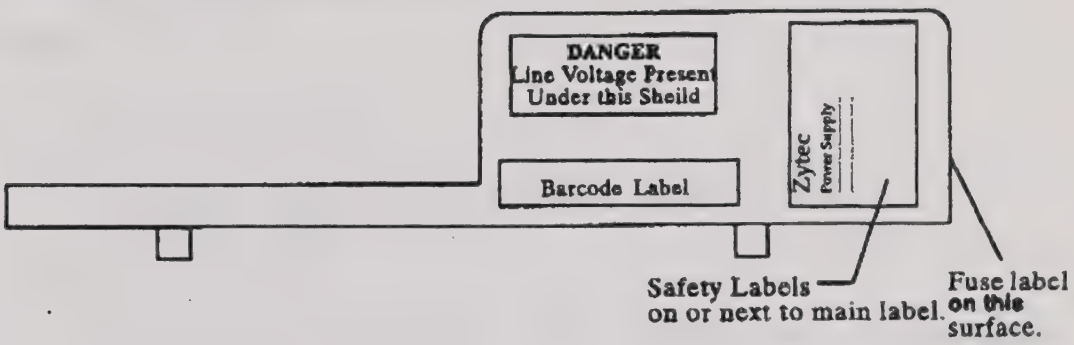
4.2.2. LOT AND UNIT IDENTIFICATION

Lot, unit, revision level, and manufacturers name or trademark markings shall be present on each power supply module.

4.2.3. BAR CODE LABEL

A bar code label shall be present on the power supply module with the following properties:
1) Symbology must comply with ANSI/EIS–566–1988 Bar Code Label Standard.
2) Label must be on top panel so as to be visible when installed in the system.
3) The first two characters of the data field (field identifier) must be "1S".
4) The characters following the field identifier must uniquely identify each power supply and the order in which it was manufactured.
5) The bar code must be accompanied by the (human readable) characters that the code represents.

4.2.4. LABEL LOCATIONS



4.3 FORCED AIR ACROSS POWER SUPPLY (PROVIDED BY SYSTEM)

20 CFM (minimum) at 0.1 inches H_2O static pressure

The air temperature rise at the power supply location above system external ambient is 10 C (typical).

4.4 MAINS INPUT CONNECTOR / PANEL MOUNT FILTER / FUSE HOLDER

Delta model 04BEEG3H or equivalent with IEC 320 type mains inlet

4.5 MAINS FUSE

(5 x 20 mm size): UL 198G & CSA C22.2, No. 59, Time–Lag : 3 Amp, 250V
example: Bussman type GMC
The vendor shall install and ship the above style fuse in the power supply.

(5 x 20 mm size): IEC 127, sheet 3, type T : 3.15 Amp, 250V
example: Littlefuse 218000 series

3.27.2. CIRCUIT ISOLATION

The Line–Trigger signal shall be safety isolated from the Mains.

3.27.3. MAINS TO SIGNAL VOLTAGE ATTENUATION RATIO

1000 ±15%
measured through a 1–pole RC low pass filter: 1k Ohm, 0.1 µF

3.27.4. MAINS TO SIGNAL VOLTAGE PHASE SHIFT

±10 degrees (maximum) at 60 Hertz
measured through a 1–pole RC low pass filter: 1k Ohm, 0.1 µF

3.27.5. NOISE CONTENT

As specified in the Load and Control Channel PARD section.

4 MECHANICAL SPECIFICATIONS

4.1 POWER SUPPLY CONSTRUCTION

4.1.1. DIMENSIONS

4.5 in. (114mm) X 2.65 in. (67.3mm) X 10.7 in. (272mm) (all nominal dimensions)

4.1.2. WEIGHT

1.76 pounds (0.8 kg) (nominal)

4.1.3. SOLDER MASK MATERIAL

Representative masked circuit board samples and solder mask technical data shall be submitted to Tektronix for approval.

4.1.4. SOLDER MASK COVERAGE

Coverage shall be 100% (except for component solder connection pad) over top and bottom surfaces.
Coverage shall extend to the edge of the circuit board.
Coverage shall extend between all unconnected plated regions.

4.1.5. CIRCUIT BOARD BACK SIDE PROTRUSIONS

≤ 0.1 inches from the surface of the circuit board

4.1.6. METAL SURFACE FINISH

Aluminum: Etch and Light Yellow Chromate Conversion Coating (MIL–C–5541C Class 3, Test per Tektronix, Inc., Std 062–2868–00) or alternate finish approved by Tektronix

Steel: Zinc or Cadmium plated (stainless steel is acceptable unplated)

4.1.7. FINISHED ASSEMBLY IONIC SURFACE CONTAMINATION

< 7 micro–grams / sq. in. equivalent NaCl as measured using Kenco Omega–meter. Surface area estimate, IPA concentration, and volume of liquid to be used in the measurement of resistivity and in the calculation of equivalent NaCl ionic content shall be submitted to Tektronix for approval.

+8.6V (1,2)	0.5	2.5
+5VD and +5VA (3)	3.5	5
−5VA (2)	1.5	2.5
−8.6V (2)	1	2.5

(1) +8.6V is sourced from +15V, therefore, the current values listed are the sum of currents for the two channels.

(2) Current limits are set by 3−terminal regulators as well as the switcher current limit. Since 3−terminal regulators also have thermal limit protection, the actual current limit may depend on ambient temperature and duration of overcurrent condition.

(3) +5VD and +5VA channel currents are summed prior to current sense.

3.25 HIGH OPERATING TEMPERATURE PROTECTION

A means of sensing excessive operating temperature and disabling the power supply shall be provided to protect the system if the module temperature should become elevated beyond a safe operating level, for instance due to a fan failure.

An overtemperature condition shall initiate an orderly shutdown whereby proper control signal timing is maintained.

3.26 "ON/STANDBY" (INPUT CONTROL SIGNAL)

3.26.1. FUNCTIONALITY

The "On/Standby" logic signal shall provide control of the transfer of power to the load channels. A contact closure to ground shall toggle this function.

The "On/Standby" logic signal shall be energized when rated mains voltage is present at the power supply mains inlet. (A mains disconnect switch is not used.)

3.26.2. INPUT CIRCUIT TOPOLOGICAL MODEL

1.2 Vdc in series with 5.5k Ohms (typical), Thevenin equivalent circuit

3.26.3. CIRCUIT ISOLATION

The On/Standby signal shall be safety isolated from the Mains.

3.26.4. VOLTAGE THRESHOLD LEVEL

0.75 Volt (typical)

3.26.5. ACTIVE INPUT VOLTAGE TRANSITION

A negative voltage transition shall toggle the transfer of power, "ON to Standby" and "Standby to On", from the primary to the secondary.

3.26.6. SWITCH DE−BOUNCING HOLDOFF TIME

125 ± 25 mseconds.

3.27 "LINE−TRIGGER" (OUTPUT CONTROL SIGNAL)

3.27.1. FUNCTIONALITY

The Line−Trigger signal shall be a scaled replica of the Mains voltage waveform. The signal shall be present when the Mains rated mains voltage is present at the power supply mains inlet connector.

+8.6V	1 %	100 µsec	10 mA
+5VD	1 %	1 msec	100 mA
+5VA	1 %	1 msec	70 mA
−5VA	1 %	100 µsec	70 mA
−8.6V	1 %	100 µsec	35 mA

Notes on Transient Recovery measurement:

1) Settling time is the time from peak overshoot to 1% of final value.
2) Over/Under Shoot is specified as percent of final value.
3) Measurement BW = 0.16 Hz to 160 KHz.

3.22 LOAD AND CONTROL CHANNEL PARD

[pk−pk] (maximum)

Channel	5 – 16k Hz BW	10k – 1M Hz BW	70k – 20M Hz BW
+15V	50 mV	150 mV	200 mV
+8.6V	10 mV	25 mV	35 mV
+5VD	25 mV	50 mV	60 mV
+5VA	10 mV	25 mV	35 mV
−5VA	10 mV	25 mV	35 mV
−8.6V	10 mV	25 mV	35 mV
LineTrigger	not specified	5 mV	25 mV

3.23 LOAD CHANNEL OVERVOLTAGE PROTECTION THRESHOLD

Load channel voltage levels within the ranges indicated shall result in protective action by the power supply to shut down

Channel	V_{min}, [Volts]	V_{max}, [Volts]
+15V	17.25	21
+8.6V	9.9	15
+5VD or +5VA (1)	5.75	7
−5VA	−7.5	−5.75
−8.6V	−12	−9.9

(1) +5VD and +5VA are common at the power supply and therefore have a common overvoltage sense. Overvoltage measurement of +5VA or +5VD must be accomplished by separating the overvoltage circuit from the channel output.

3.24 LOAD CHANNEL OVERCURRENT PROTECTION THRESHOLD LEVEL

Load channel current levels within the ranges indicated shall result in protective action by the power supply to shut down

Channel	I_{min}, [Amps]	I_{max}, [Amps]
+15V (1)	4	5

An external thermal printer is supplied current from +15V through an internal system regulator.

Maximum continuous current occurs when printing a solid image.

Maximum peak current occurs for 6 msec during printer power up.

3.19 LOAD CHANNEL DC VOLTAGE INITIAL SETPOINT

(Vmains = 120Vrms, 60Hz; Tamb = 25°C; Iload = +15V @ 1.4A, +8.6V @ 0.1A, +5VD @ 1A, +5VA @ 0.7A, −5VA @ 0.7A, −8.6V @ 0.35A)

Channel	Vmin [Volts]	Vnom [Volts]	Vmax [Volts]
+15V	13.8	15.0	15.75
+8.6V	8.385	8.6	8.815
+5VD	4.875	5.0	5.125
+5VA	4.875	5.0	5.125
−5VA	−5.125	−5.0	−4.875
−8.6V	−8.815	−8.6	−8.385

3.20 LOAD CHANNEL DC VOLTAGE VARIATIONS FROM SETPOINT

(maximum)

Channel	Load Effect(1)	Cross−Load Effect(2)	Mains Effect(3)	Temperature Effect(4)
+15V	1.6 %	5.0 %	0.6 %	1.5 %
+8.6V	0.2 %	0.1 %	0.2 %	0.5 %
+5VD	0.3 %	0.3 %	0.2 %	0.5 %
+5VA	0.5 %	0.4 %	0.2 %	0.5 %
−5VA	0.6 %	0.4 %	0.2 %	0.7 %
−8.6V	0.3 %	0.3 %	0.2 %	0.5 %

(1) Load Effect: (Vmains = 120Vrms, 60Hz; Tamb = 25°C; $I_{test.channel} = I_{min}$ to I_{max} ; $I_{other.channels}$ = +15V @ 1.4A, +8.6V @ 0.1A, +5VD @ 1A, +5VA @ 0.7A, −5VA @ 0.7A, −8.6V @ 0.35A)

(2) Cross−Load Effect: (Vmains = 120Vrms, 60Hz; Tamb = 25°C; $I_{test.channel}$ = +15V @ 1.4A, +8.6V @ 0.1A, +5VD @ 1A, +5VA @ 0.7A, −5VA @ 0.7A, −8.6V @ 0.35A; $I_{other.channels} = I_{min}$ to I_{max})

(3) Mains Effect: (Vmains = 90 to 275 Vrms, 60Hz; Tamb = 25°C; Iload = +15V @ 1.4A, +8.6V @ 0.1A, +5VD @ 1A, +5VA @ 0.7A, −5VA @ 0.7A, −8.6V @ 0.35A)

(4) Temperature Effect: (Vmains = 120 Vrms, 60Hz; Tamb = 0 to 50 °C; Iload = +15V @ 1.4A, +8.6V @ 0.1A, +5VD @ 1A, +5VA @ 0.7A, −5VA @ 0.7A, −8.6V @ 0.35A)

3.21 LOAD CHANNEL TRANSIENT RECOVERY VOLTAGE RESPONSE

Channel	Over/Under Shoot (maximum) [Volts]	Settling Time (maximum) [msec]	Test Load Step Current [Amps]
+15V	5 %	1 msec	140 mA

3.9 LOAD CHANNEL SHORT CIRCUIT DURABILITY

Each load channel output shall be able to withstand a continuous secondary resistive overload to any other secondary voltage output or to ground without damage to the power supply.

3.10 DYNAMIC LOAD SYNCHRONIZATION IMMUNITY

PWM Oscillator(s) shall not synchronize to external line or load repetitive disturbances.

3.11 LOAD CAPACITANCE COMPLIANCE

+5VA, +5VD, +15V: 0 to 200 µF / rated Amp.

+8.6V, −8.6V, −5VA: 0 to 100 µF / rated Amp.

3.12 NO LOAD CONDITION DURABILITY

A no−load condition on any one or more load channels shall not cause damage to the power supply.

3.13 LOAD CHANNEL REVERSE POLARITY PROTECTION

All DC output channels shall be connected to a reverse biased diode stack to provide reverse polarity protection. Each diode must have a current rating that is equal to or greater than the rating of highest current channel

3.14 LOAD CHANNEL DC OPERATING QUADRANT

Load channels shall act as single quadrant sources. Positive supplies shall only source current and negative supplies shall only sink current.

3.15 ELECTRICAL ADJUSTMENTS

No electrical adjustments are permitted.

3.16 LOAD CHANNEL BEHAVIOR AT POWER UP AND POWER DOWN

monotonic voltage change

3.17 LOAD POWER OPERATING RANGE

19 Watts (typical), with minimum rated continuous load all channels
55 Watts (typical), with maximum rated continuous load all channels

3.18 LOAD CHANNEL INDIVIDUAL CURRENT RATING

Channel	I_{min} [Amps]	$I_{max,\ continuous}$ [Amps]	$I_{max,\ peak}$ [Amps]
+15V	0.7	2.1	3.1
+8.6V	0.05	0.15	0.15
+5VD	0.7	1.5	1.5
+5VA	0.3	1.0	1.0
−5VA	0.3	1.0	1.0
−8.6V	0.2	0.5	0.5

+15V load channel current notes:
A +12 V rated fan is supplied current from +15V through a 16 Ohm resistor.

1 DESCRIPTION

POWER SUPPLY: 55W; +15V 2.1A, +8.6V 0.15A, +5VD 1.5A, +5VA 1A, −5VA 1A, −8.6V 0.5A; 90−132 VAC, 47−440 Hz; 90−275 VAC, 47−63 Hz; 114 x 67 x 272 mm

1.1 PURPOSE OF THIS DOCUMENT

This document contains a description of the qualities, traits, and properties that describe and distinguish the power supply module for use in test and measurement oscilloscope equipment. The power supply is considered a modular unit which may easily be installed, removed or replaced as a functional sub−system. The characteristics in this document pertain to the complete power supply installed into the "end use" equipment chassis unless otherwise indicated.

1.2 DEFINITIONS

1.3 PERFORMANCE VERIFICATION AND ACCEPTANCE TESTING

2 TEKTRONIX, INC., SAFETY CONTROLLED PART

This part is controlled to ensure maintenance of safety characteristics designed into a Tektronix, Inc. product. To continue maintenance, any changes in material, specification, vendors, or vendor's part number must be evaluated and approved by Tektronix Product Safety in each application in which this is a controlled part.

3 ELECTRICAL CHARACTERISTICS

3.1 MAINS VOLTAGE AND FREQUENCY STEADY STATE AMPLITUDE

(One Range) universal input;
90 to 275 VAC, 47 to 63 Hertz.
90 to 132 VAC, 47 to 440 Hertz.

3.2 MAINS VOLTAGE CREST FACTOR

1.30 to 1.41.

3.3 MAINS CURRENT STEADY STATE AMPLITUDE

1.5 Amps RMS (maximum)

3.4 MAINS CURRENT INRUSH

90 A (maximum).

3.5 MAINS POWER FACTOR

0.5 (minimum)

3.6 EFFICIENCY

35 % (minimum)

3.7 MAINS INPUT REAL POWER

90 Watts (maximum)

3.8 MAINS INPUT APPARENT POWER

150 VA (maximum)

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